DOCUMENT RESUME

ED 202 154 EA 013 607

TITLE	Domestic Research at Rand.
INSTITUTION	Rand Corp., Santa Monica, Calif.
PUB DATE	Jan 81
NOTE	294p.
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Agency Role; Computer Oriented Programs; Crime; Drug Abuse; Economic Development; Educational Finance; Educational Research; Electricity; Federal Programs; Fire Protection; Government School Relationship; Health Insurance; Health Personnel; Housing; Labor Market; Law Enforcement; Literature Reviews; Medical Care Evaluation; Medical Education; Older Adults; Population Growth; Postsecondary Education; Program Descriptions; Program Evaluation; Public Policy; Research Design; *Research Projects; School Administration; Social Action; *Social Problems; Social Science Research; Social Services; Urban Population; Urban Problems
IDENTIFIERS	Energy Consumption; Energy Development; Energy Policy; New York (New York); Regulatory Agencies

ABSTRACT

This third descriptive inventory of the Rand Corporation's domestic non-military research covers all projects since 1972, as well as its special 1969-1975 program for New York City. For each of over 300 research projects in nine program areas, brief summaries identify the project title and sponsor, beginning and ending dates, person-years of work performed, principal investigators, research problem and results, and selected project publications. The nine areas comprise the following: (1) criminal justice, focusing on street crime; (2) education and human resources, including educational finance, governance, evaluation, research, postsecondary education, and human services; (3) energy policy, production, and use; (4) health sciences, especially health insurance, education, manpower, and care quality; (5) housing problems, markets, and related government programs; (6) labor and population studies, touching on labor markets, economic development, and population growth; (7) regulatory policies and institutions and their effects and processes; (8) urban policy, including the effects of federal, state, and local policies; and (9) a general category covering water management, communications, climate, air pollution, computers, and science and technology. The New York City program examined welfare, health, housing, fire protection, law enforcement, criminal justice, and water resources. An appendix lists all U.S. and foreign libraries maintaining collections of unclassified Rand publications. (Author/RW)

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DOMESTIC RESEARCH AT RAND

JANUARY 1981

EA 013 607

Rand

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DOMESTIC RESEARCH AT RAND

JANUARY 1981

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PREFACE

The Rand Corporation is an independent, nonprofit research organization chartered in 1948 as a California corporation "to further and promote scientific, educational, and charitable purposes, all for the public welfare and security of the United States of America."

From 1948 until the late sixties, most of Rand's work dealt with issues of national defense. This work, sponsored mainly by the U.S. Air Force and other agencies of the Department of Defense, concentrated on such topics as defense strategies, forces, budgets, weapon development, and military support systems. But it included a few non-defense studies as well. In 1949 Rand published its first study in the field of health, on the frequency of mental illness. Other early health studies, produced through the fifties, examined such subjects as human vision, the external respiratory system, peptic ulcers, and chemotherapy. In addition to health, one can find scattered throughout that period products of Rand research in education, transportation, energy, water supply, and the operations of government. Underlying these studies was research in the basic areas of mathematics, computer science, economics, psychology, and other disciplines with broad application to problem-solving in both the defense and the civil sectors of society.

By 1967 the scope of Rand's research had begun to broaden to include a more comprehensive and systematic program of domestic studies. This broadening continued over the next few years, until today Rand's programs in national security and domestic research are roughly of equal size.

Rand is organized into three divisions: National Security Research, Project AIR FORCE, and Domestic Research. Each is headed by a vice president. Gustave H. Shubert was head of the Domestic Research Division from its creation in 1967 to 1979. David W. Lyon became head of the division in 1979. Mr. Shubert, in addition to his responsibilities as Senior Vice President, is currently Director of Rand's new Institute for Civil Justice. The purpose and activities of the Institute are described in a separate document, *A Report on the Organizational Phase: July 1979-March 1980*, available from Rand's Publications Department.

This third edition of *Domestic Research at Rand* has been compiled to provide a thorough inventory and description of domestic research carried out at Rand since 1972. Over 300 projects are summarized by nine different program areas: Criminal Justice, Education and Human Resources, Energy Policy, Health Sciences, Housing Studies, Labor and Population Studies, Regulatory Policies and Institutions, Urban Policy, and Other Domestic Research. The research results of the studies discussed are documented in reports, notes, books, journal articles, and papers. The publications cited beneath project descriptions are necessarily selective. They are included to

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illustrate the range and breadth of research products ensuing from Rand studies; space limitations in this volume do not permit a complete listing. Special bibliographies of Rand publications in many of the subject areas above are available from Rand's Publications Department upon request.

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INTRODUCTION

THE NATURE OF RAND RESEARCH

The hallmark of Rand research is that it examines systematically as many relevant aspects of a problem in as large a context as possible. Thus a typical Rand study is addressed to policymakers. It identifies and evaluates alternative solutions or courses of action, taking into account their costs and benefits and their sensitivity to future developments—features that may or may not be part of current assumptions. Energy research is a particularly good example of an area characterized by many variables and uncertainties. These include the world price of oil, the demand for energy, the possibility of technological innovation, and the risk of environmental hazard, all of which must be understood and balanced in developing alternative courses for energy policy analysis. In education, Rand's Policy Research Center, sponsored by the U.S. Department of Education, considers questions of school governance and finance in the context of judicial reform and changing economic, political, and demographic factors.

Estimating the costs of administering a social program is largely an economic enterprise, and economics is well represented among the academic disciplines at Rand. But the research view extends beyond strictly economic concepts to include human and social, as well as monetary, costs. Moreover, costs are defined more subtly than they once were to account for distributional and other side effects—that is, the degree to which programs affect income groups or other classes of people differently, or produce inadvertent effects on the environment.

A case in point is Rand's study of the economic impacts of regulating fluorocarbons, a widely used industrial chemical that scientists fear is depleting the earth's fragile ozone layer. Researchers examined the effectiveness and costs of two strategies for controlling emissions—one based on mandatory controls and the other on economic incentives—and concluded that if modest levels of emissions reduction were acceptable, either approach would do the job. However, the distributional effects of the two policies would differ greatly, with industry bearing the brunt of costs under incentives and society as a whole sharing the costs of mandatory controls. They further found that if large reductions in emissions were necessary, then mandatory controls would not suffice and the policy choice would have to be between an outright ban on fluorocarbon use and economic incentives, with exceedingly high attendant costs in either case. Under a ban everyone would suffer—user groups and the economy alike. The costs of an incentives approach, however, would fall heaviest on industry and some method of compensation would be necessary to prevent layoffs and wholesale plant closures.

Determining whether a social program will confer the benefits claimed for it is in part the work of economists, but other disciplines are equally important in discovering and explaining the underlying reasons for the social or economic behavior that policy is aimed at—what makes people buy a certain type of health insurance, for example, or decide to bear another child. Or what goes into making a city work. A study of urban policy that Rand conducted from 1974 to 1977 brought to bear the diverse skills of regional planners, demographers and sociologists—as well as economists—to assess the effects on cities of broad federal programs. They concluded that the most important impacts were often inadvertent—unplanned side effects of programs that were not specifically urban in intent but that had profound and, for the most part, deleterious consequences for the nation's cities. Among these were federal mortgage underwriting practices that favored new housing in homogeneous neighborhoods on cheap land and gave rise to the booming, predominately white suburbs of the postwar period. The strong federal backing for more productive farm technology succeeded in greatly improving farming methods but also drove many poor and unskilled farm workers into the cities and on to the welfare roles. And while the development of the interstate highway system made possible the steady outward expansion of the suburbs, it also drew off revenues from the inner cities, hastening their decay.

One can classify many of the research projects listed here under the rubric of "systems analysis"—the systems in question including the educational system, the criminal and civil justice systems, the health-care system, federal agencies' management practices, the welfare system, regulated industries such as communications and power, and systems for introducing social change. But some of the projects can also be classified according to a special perspective or technique. These classifications include *evaluations, social experiments, study design, modeling, literature review and synthesis,* and *applied science and technology.*

Evaluations test the procedures and results of an existing rather than a proposed program or system to see whether it is working as it is supposed to and whether its objectives could be met more effectively in other ways. Evaluating federal policies aimed at apprehending, prosecuting and sentencing serious repeat offenders—so called "career" criminals—is an ongoing feature of Rand's criminal justice program. Recent findings suggest that the push to put more of these felons behind bars for longer periods of time may backfire, straining the capacity of some already overcrowded prisons to the breaking point.

One of the largest evaluation projects undertaken by Rand was a four-year study of federal efforts to promote innovation in the public schools. These ambitious programs, which absorbed about 10 percent of the total government investment in elementary and secondary education, fell far short of their goals because of a mistaken assumption that social problems, like some technological ones, can be "solved" by massive infusions of money and technical expertise. The programs were meant to introduce new educational practices aimed, for example, at improving reading and bilingual skills, and to disseminate

successful programs. But the attempts of government, however well intentioned, to impose change from above did not mesh with the realities faced by teachers and principals on the firing line who had to make the programs work. In many cases, the guidelines and management strategies of the "change agent" programs were simply overwhelmed by local concerns. The key to effective federal policy in the future is an understanding of and respect for the way the educational process works at the local level, Rand found.

Social experiments are a relatively new kind of policy research. They investigate major proposed programs by trying them out experimentally instead of projecting their effects on the basis of available and often inadequate data. In the past, large public programs have sometimes developed difficulties unanticipated in the original planning. Medicare, Medicaid, and public housing, for example, ultimately had to be severely modified because of unpredicted effects: soaring costs and inflationary impact on the health care system in the case of Medicare and Medicaid, and high costs and narrow benefits in the case of public housing. Today, in three Rand projects, new policies in health care, housing, and energy are being tested experimentally using representative populations in representative locales.

In the Health Insurance Study, Rand is "running" an insurance company, signing up about 2750 families for fifteen different types of health insurance policies that Rand designed. The participating families replace their existing health insurance policies with a test policy, but the experiment is just as carefully designed to protect participants against loss as it is to preserve the validity of the research results.

All of the participating families file claims with the study and are interviewed once a year—three-quarters of them for three years and the remainder for five years—to produce data on the state of their health. Analysis of the massive amount of detail showing how the experimental families in each plan obtained health care is intended to show how many medical services individuals and their physicians would use under alternative kinds of health insurance. Perhaps even more importantly, the study will shed light on the question of how much, if at all, insurance affects health and quality of care.

The Housing Assistance Supply Experiment (HASE) is the most complex of a group of federally funded experiments meant to examine the effects of giving low-income families cash allowances to supplement their own rent or mortgage payments. This approach is in contrast to such forms of assistance as public housing or general income subsidies. Designed initially to test the impact of a national allowance program on the housing market—the response of landlords, financial institutions, realtors, and others—the experimental charter was later broadened to include an assessment of community response as well. The effects, if any, on neighborhood social patterns and on community attitudes toward program participants were among the questions examined here.

Low-income families in two metropolitan areas were enrolled for ten years, during the first five of which the program and its market effects were carefully monitored. Now well into its sixth year, the experiment is yielding

its findings. Housing allowances are a source of long-term aid for single parents and the elderly—two of the nation's most needful groups. They do not destabilize neighborhoods or otherwise disrupt the housing market. And because administrative costs can be kept in bounds, they are a relatively low-cost and efficient way of helping to meet the housing needs of the poor. This experiment and others will help the Department of Housing and Urban Development determine the feasibility, costs, and benefits of a national housing allowance program.

The Los Angeles Electricity Rate Study was begun in the spring of 1975, when the Los Angeles Department of Water and Power obtained permission to conduct a time-of-day rate experiment using 2000 households. Rand was given overall analytic responsibility for the study, including design of the experiment and analysis of the results. Rand staff members have also supervised the training of interviewers and have monitored the quality of data collection.

The purpose of the experiment was to test the hypothesis that electricity customers will adapt their consumption patterns to take advantage of lower rates. Electric utilities have historically offered bargain rates to the heaviest users. In the days of cheap energy, this made sense because it served to attract new industry. But with the advent of soaring fuel prices, the wisdom of using rate structures that were not closely tied to the costs of power production came under serious question. The costs of supplying electricity vary by time of day, day of week, and season of the year, with the highest costs occurring at the times of greatest demand. Thus, if customers can be induced by lower prices to shift their use of electricity to off-peak hours, then utilities will be able over time to reduce both operating and capacity costs. Results of the study to date indicate that peak-load pricing for private residences may not be feasible at present because the gains to consumers are offset in most cases by the high cost of installing and reading the meters. However, a companion study conducted by Rand of the European experience with this method of pricing suggests that peak-load pricing for American industry should be encouraged now.

Study design is a common feature of Rand projects. Extensive preliminary work is sometimes called for when a large and complex research project is to be undertaken. The purpose here is to examine the rationale and analytic methods that will underpin the larger study. The health and housing experiments, for example, required elaborate studies before a research design could be formulated. Examples of study design efforts in other fields include the design of a long-term study of the impact of school desegregation nationally, an evaluation study of the pre-school education program Head Start, a study of the experimental public service applications of cable television, and a study currently underway to evaluate a school-based preventive dental care program for children.

Modeling is a technique frequently used in Rand research. In the analytic context a "model" is a mental construct of a system, or situation, that can be described in a number of ways, e.g., in mathematical expressions, computer

programs, diagrams, or everyday language. It is meant to represent the essential nature of phenomena that cannot be studied directly at reasonable cost. By changing the terms of a well-constructed model that has been validated empirically, and observing how those changes affect other parts of the model, a researcher tries to predict what would happen if analogous changes were introduced in the real-life situation portrayed by the model. The limitations of modeling are inherent in the fact that models are, by their nature, only abstracts of reality.

In current projects, Rand is constructing computer-based mathematical models of such phenomena as the chemistry and mechanics of life functions, tidal flows and the dispersion of pollutants in tidal basins, school budget allocation decisions, migration and labor supply, fertility patterns, and groundwater use and management in California.

Literature review and syntheses is a useful type of research in areas that have already been subjected to extensive but fragmented treatment. The literature about broadcasting and communications, for example, is voluminous, of varying quality, and often partisan in point of view. Rand has reviewed and evaluated that literature to determine what information it contains for policy guidance, and where it is deficient as a basis for public or private action. Much has been written, as well, about the problems of the elderly, secondary education, the development of urban areas, welfare reform, desegregation—all subjects that Rand has explored through analysis of existing data and literature.

In those fields of *applied science and technology* requiring laboratories, Rand collaborates with other institutions such as research hospitals and universities. But many of Rand's applied science and technology projects do not require physical experimentation. Four projects that suggest the range of interests in this area are feasibility studies of ocean thermal energy conversion—the promising new technology for extracting electric power from the sea—the application of game theory to economic concepts, the use of Mariner photographs to develop a coordinate system for mapping Mars and Mercury, and the adaptation of closed-circuit television to help the partially sighted read and write.

Computer science is a major component of the entire research program. It supports such activities as model building and the complex information-processing tasks required to handle the data coming in from the housing assistance and health insurance experiments; and it is applied in such projects as developing machines that mimic human intelligence, or analyzing the technical possibilities for protecting personal information held in computerized data banks.

One impression that emerges from the projects described in this volume is that considerable social invention is in progress. The rising demand for social change to correct inequities and ease the adaptation to new circumstances in the nation's economic and social life has prompted governments, private foundations, and others to support novel and experimental research. Research and analysis may not provide all the answers, but they can help to

inform and refine the negotiation between the public need and the private purse.

SPONSORS

Contracts and Grants

In the period covered in this report, Rand's Domestic Research Division received $153.5 million in contracts and grants, with the bulk of the funding coming from federal government agencies. The Department of Health, Education, and Welfare accounted for one-third of this amount. Altogether, federal government agencies contributed a total of $131 million. Foundations accounted for $8.5 million and state and local governments provided $4.2 million. The remainder came from a variety of sponsors, including the Netherlands Rijkswaterstaat, universities, and medical and other research centers.

Two long-term social experiments, in health and in housing, accounted for over one-third of the total domestic division funds. They are described in project summaries in the body of this report.

Rand-Sponsored Research

A limited amount of research was financed during this period from Rand's fee income, the only source of money for self-initiated research. These funds have traditionally been used to support exploratory ideas of Rand staff, important research for which no sponsor is available, and activities that enhance the professional employee's research experience.

For example, in the past five years, $1.2 million of the income has supported such domestic research studies as the history of bilingual education in the United States and the social effects of changes in educational policy. Health research on the effects of low-level ionizing radiation, the identification of biological hazards, drug resistance in tumor cell populations, and a synthesis of prior alcoholism studies also fall in this category. Energy subjects have included an analysis of electricity pricing and an assessment of energy conservation incentives as they relate to national objectives and long-term conservation strategy. Work on urban problems has focused on a study of the American metropolis in the year 2000, cyclical employment behavior in states and localities, demographic trends and their implications for public policy, Mexican-American relations, and the effects of fiscal limitations on the provision of services by state and local governments.

Rand-sponsored studies have resulted in publications on educational evaluation, cost analysis of light water reactor power plants, urban policy issues, and occupational radiological risk across industries.

Rand funds also support the preparation of books, often based on earlier Rand studies. Some recent examples:

- *Fire Department Deployment Analysis*
- *Nuclear Power and the Public Safety: A Study in Regulation*
- *Female Labor Supply: Theory and Estimation*
- *The Federal Interest in Financing Schooling*
- *Changing Urban Bureaucracies: How New Practices Become Routinized*
- *Development and Diffusion of the Nuclear Power Reactor: A Comparative Analysis*
- *Television and Human Behavior*
- *The Adviser*
- *Handicapped Children: Strategies for Improving Services*

In addition to books and reports, work at Rand occasionally results in inventions such as "Improvements in Reverse Osmosis/Hyperfiltration Process for Treating Water and Other Fluids," by James C. De Haven. The theory underlying this invention resulted from investigations carried out for the Netherlands Rijkswaterstaat.

LEVEL OF EFFORT

The Domestic Division's budget was $8.5 million in Fiscal Year 1973. It rose to $15.5 million in Fiscal Year 1976 and $18.3 million in Fiscal Year 1980.

Staffing levels were 163 professionals in Fiscal Year 1973, 257 in Fiscal Year 1976, and 247 in Fiscal Year 1980.

REPORTS

The products of Rand research are reports of progress and findings in both briefing and written form. In the past five years Rand's domestic research has been documented in some 3000 publications of various kinds, ranging from working papers to formal reports and books. Rand reports are available to the public either directly from Rand or through other sources such as professional journals, government documentation centers, and a unique worldwide network of public and university library collections. *Selected Rand Abstracts*, a quarterly journal, provides author and subject indexes and contains abstracts of publications. The indexes, as well as the bibliographies mentioned earlier, are available in several thousand public and university libraries, and from

Rand. Highlights of selected current studies are summarized in a quarterly newsletter, *Rand Research Review*. Annual subscriptions to all unclassified publications may be obtained for a modest charge by contacting Rand's Publications Department. Rand books published by university or commercial publishers may be obtained from libraries and booksellers.

CRIMINAL JUSTICE

Peter W. Greenwood, Program Director

The primary objective of Rand's Criminal Justice Program is to provide new knowledge that can contribute to improved policies or practice for dealing with urban street crime. A secondary objective is to develop new research and planning methodologies.

Early program studies focused on specific operational issues such as patrol car allocation, managing criminal investigations, the prosecution of felony defendants, citizen patrols, the treatment of serious juvenile offenders, and private police. Most of these projects resulted in specific recommendations that were later incorporated into practice.

In 1975 Rand began a new series of studies emphasizing patterns of individual criminal behavior. This research, which relies on self-reported data from incarcerated offenders, is intended to identify personal and behavioral characteristics associated with the most serious level of criminality, and to provide estimates of the crime prevented by alternative sentencing policies. Related studies deal with sentencing policy during the transition from juvenile to adult court and with the prison experience of career criminals.

Several studies treat methodological questions related to Rand's more applied work—the evaluation of criminal justice models, court performance measures, criminal justice research standards and goals, and improved statistical techniques for estimating individual crime characteristics from self-reported data.

Recent projects consider the impact of unique policy initiatives. These include studies of the effects of California's new Determinate Sentencing Law and of budget reductions caused by Proposition 13. Another recent study is examining the process by which research affects criminal justice practice.

CRIMINAL CAREERS

Department of Justice (National Institute of Justice)

Term and Scale of Effort: 6/75 - 7/81; 29.2 person years

Principal Investigator: Peter W. Greenwood

This multi-year grant is supporting research on specifically negotiated subjects of interest to the National Institute of Justice and to Rand, as well as on Rand-initiated projects. The work focuses on the problems of identifying high-rate offenders and generating accurate estimates of the incapacitation effects that can be expected from particular sentencing policies. The key parameters that must be estimated for these analyses are individual offense rates and probabilities of arrest. However, in addition to these basic parameters, which are necessary to model an offender's criminal behavior, our interviews and analyses have generated information on a variety of other offender characteristics such as motivation for crime, attitudes toward the system, and the utility placed on legitimate as distinct from criminal activities. This information provides a rich empirical basis for generating new hypotheses concerning particular forms of criminal behavior and career development and their amenability to criminal justice system intervention. Staff are available to provide technical assistance to the National Institute in reponse to new developments and problems as they arise.

A recently completed Rand survey of more than 2500 prison and jail inmates provides self-reported information on criminal activities, attitudes, and other characteristics. Official record data on the prison inmates were also obtained. The survey data will be analyzed to identify offender characteristics that may be correlated with particular types of criminal behavior, and to develop an offender typology reflecting systematic differences in behavior patterns. The information on offender characteristics will be used in estimating the incapacitation effects of alternative sanction policies and will provide policy guidance on a variety of criminal justice activities.

R-2144-DOJ, *Criminal Careers of Habitual Felons*, J. Petersilia, P. W. Greenwood, and M. Lavin, August 1977.

R-2200-DOJ, *Doing Crime: A Survey of California Prison Inmates*, M. A. Peterson, H. B. Braiker, and S. M. Polich, April 1980.

R-2637-DOJ, *Quality of Prisoner Self-Reports*, K. H. Marquis, forthcoming.

N-1286-DOJ, *Rand Research on Criminal Careers: Progress to Date*, P. W. Greenwood, August 1979.

N-1505-DOJ, *Data Tape for the Rand 1976 Survey of California Prison Inmates*, M. A. Peterson, S. M. Polich, and J. M. Chaiken, June 1980.

"Developing Programs for the Habitual Offender: New Directions in Research," J. Petersilia, in C. Ronald Huff, *Issues in Contemporary Corrections: Social Control and Conflict*, Sage Publications, 1978.

"The Validity of Criminality Data Derived from Personal Interviews," J. Petersilia, in C. F. Wellford (ed.), *Quantitative Studies in Criminology*, Sage Publications, 1978.

"Mandatory Prison Sentences: Their Projected Effects on Crime and Prison Populations," P. W. Greenwood and J. Petersilia, *The Journal of Criminal Law and Criminology*, Vol. 69, No. 4, 1978.

"Criminal Career Research: A Review of Recent Evidence," J. Petersilia, in N. Morris and M. Tonrey (eds.), *Crime and Justice: An Annual Review of Research*, Vol II, University of Chicago Press, forthcoming.

"Career Criminal Prosecution: Potential Objectives," P. W. Greenwood, *The Journal of Criminal Law and Criminology*, Vol. 71, No. 2, Summer 1980.

KNOWLEDGE UTILIZATION IN CRIMINAL JUSTICE: A POLICY APPROACH

Department of Justice (National Institute of Justice)

Term and Scale of Effort: 1/80 – 1/82; 4.3 person years

Principal Investigator: Phyllis L. Ellickson

A Congressional report on domestic technology transfer begins by declaring that the goal of knowledge utilization "to put it bluntly, is to get more out of science." The pressure to enhance knowledge utilization is as much evident in criminal justice as in other public service systems. However, the knowledge utilization process—i.e., the means by which knowledge is converted into policy and practice—is not well understood. This research project has the following objectives:

- To develop specific insights into the knowledge utilization process in criminal justice.
- To identify specific policy initiatives that may be taken to improve that process.

Staff will (a) systematically investigate the complex subprocesses—knowledge development, diffusion, and implementation—that make up the overall process of knowledge utilization, and (b) identify factors affecting these processes.

EFFECTS OF PROPERTY TAX LIMITATION ON THE CRIMINAL JUSTICE SYSTEM IN CALIFORNIA

Department of Justice (National Institute of Justice)

Term and Scale of Effort: 10/78 – 5/80; 3.4 person years

Principal Investigators: Jan M. Chaiken and Warren E. Walker

In June 1978 the electorate of California, by amending the state constitution, placed limits on collecting property tax revenue. This project was con-

cerned with the current and potential impact of this tax limitation on the state's criminal justice system, as changes occurred in the sources of local government revenue and in legal interpretations of existing legislation, and as new legislation was passed. The project documented significant trends in criminal justice agency resource allocation policies and plans. Changes in criminal justice plans and programs during the first year of experience in California were analyzed to identify future research and evaluation opportunities.

R-2483-DOJ, *Political and Legal Responses to Proposition 13 in California*, A. J. Lipson and M. Lavin, January 1980.

R-2675 DOJ, *Fiscal Limitation in California: Initial Effects on the Criminal Justice System*, J. M. Chaiken, W. E. Walker, A. P. Jiga, and S. S. Polin, forthcoming.

R-2675/1-DOJ, *Fiscal Limitation in California: Initial Effects on the Criminal Justice System, Executive Summary*, J. M. Chaiken and W. E. Walker, forthcoming.

N-1521-DOJ, *The Impact of Proposition 13 on Local Criminal Justice Agencies: Emerging Patterns*, W. E. Walker, J. M. Chaiken, A. P. Jiga, and S. S. Polin, June 1980.

"The Impact of Proposition 13 on Local Criminal Justice Agencies," *Effects of a Declining Economy on Crime and the Criminal Justice System*, W. E. Walker, J. M. Chaiken, A. P. Jiga, and S. S. Polin, Oelgeschlager, Gunn and Hain, Inc, forthcoming.

POTENTIAL IMPACTS OF DETERMINATE SENTENCING

State of California (Community Release Board)

Term and Scale of Effort: 7/78 – 7/79; .8 person years

Principal Investigators: Albert J. Lipson and Mark A. Peterson

The new California determinate sentence law has upset many existing policies for the treatment of criminal offenders. This law establishes uniform prison sentences and mandates a review of prison sentences by the Community Release Board to determine whether a sentence is disparate. It will probably produce changes in such matters as who goes to prison, the length of imprisonment for various offenders, the nature of parole supervision, the size of prison populations, the supervision and treatment of inmates within prisons, and the fiscal requirements for courts, correctional institutions, and other criminal justice agencies. This project provided information essential for evaluating the new law. Phase one identified and developed a research design for obtaining information critical to a comprehensive evaluation of the law.

Phase two focused on policy and political issues, such as how to handle the most serious offenders.

R-2497-CRB, *California Justice Under Determinate Sentencing: A Review and Agenda for Research*, A. J. Lipson and M. A. Peterson, June 1980.

THE ROLE OF JUVENILE RECORDS IN ADULT CRIMINAL PROCEEDINGS

Department of Justice (National Institute of Justice)

Term and Scale of Effort: 11/78 - 8/80; 2.1 person years

Principal Investigators: Peter W. Greenwood and Joan Petersilia

Under this grant, Rand sought to test the validity of the following premise: within the present two-track system of justice (juvenile justice and adult) with the attendant legal proscriptions on the use of juvenile records in adult court, the appropriate handling of young adult offenders is unduly hamstrung by a lack of timely and complete juvenile-record information. Rand staff described the existing situation concerning the availability of juvenile justice system records to the adult criminal justice system. The patterns of disposition of young-adult offenders were connected to the availability and use of juvenile records, and compared with juvenile disposition patterns. This analysis sought new approaches to obtaining better use of juvenile records in the criminal proceedings of young adults.

R-2642-NIJ, *Age Crime and Sanctions: The Transition from Juvenile to Adult Court*, P. W. Greenwood, J. Petersilia, and F. Zimring, forthcoming.

BAYES ESTIMATES IN STOCHASTIC MODELS OF CRIME COMMISSION RATES

Department of Justice (National Institute of Justice)

Term and Scale of Effort: 10/78 - 9/80; 1.1 person years

Principal Investigators: Jan M. Chaiken and John E. Rolph

Data bases developed at Rand contain profiles of incarcerated individuals from which a sample of offenders for this study was drawn. Information from the sample were used in devising functional forms and realistic statistical models to estimate crime commission rates. The research results should be useful for development of selective incapacitation policies.

CAREER CRIMINAL PROGRAM DEVELOPMENT RESEARCH

Department of Justice (Law Enforcement Assistance Administration)

Term and Scale of Effort: 9/77 - 9/79; 3.8 person years

Principal Investigator: Joan Petersilia

Recent years have seen a major reform in criminal justice philosophy, moving away from an emphasis on rehabilitation and individualized treatment toward a more hard-line focus on punishment, deterrence and incapacitation as sentencing objectives. This shift is based on the proposition that, although a small fraction of the total offender population accounts for a large number of the serious offenses, they are repeatedly returned to the community where they continue their criminal activities. Evidence indicates that if the criminal justice system could become more effective in deterring or containing these "career offenders," substantial reductions in crime would follow. The objectives of this research were:

- To identify and describe special police, court, or correctional projects that are designed specifically to improve the system's capability in handling the career criminal.
- To examine the interaction that is occurring between correctional agencies and the career criminal.
- To look at the relationship between offender characteristics (e.g., age, prior record) and treatment needs and treatments received.

R-2511-DOJ, *The Prison Experiences of Career Criminals*, J. Petersilia, P. Honig, and C. Hubay, Jr., May 1980.

N-1287-DOJ, *Career Criminal Prosecution: Potential Objectives*, P. W. Greenwood, August 1979.

ASSISTANCE TO THE TASK FORCE ON CRIMINAL JUSTICE RESEARCH AND DEVELOPMENT

Department of Justice (Law Enforcement Assistance Administration)

Term and Scale of Effort: 10/75 - 9/76; 4.6 person years

Principal Investigator: Robert K. Yin

Rand staff members and consultants made up the research staff of the Task Force on Criminal Justice Research and Development appointed by LEAA. The Task Force was organized under the auspices of a second National Advisory Commission on Criminal Justice Standards and Goals to develop guidelines for the conduct and management of research and development in criminal justice. The final report of the Task Force, addressed primarily to agencies at all levels of government responsible for allocating R&D resources, established an agenda of research topics deemed of high priority for the near

future and recommended policies for formulating, supporting, and evaluating criminal justice R&D to improve its quality and usefulness.

R-2018-DOJ, *Research on Criminal Justice Organizations: The Sentencing Process*, B. Cohen, January 1977.

R-2020-DOJ, *R&D Utilization by Local Services: Problems and Proposals for Further Research*, R. K. Yin, December 1976.

A SURVEY OF INTERVENTION TECHNIQUES APPROPRIATE FOR THE DANGEROUS JUVENILE OFFENDER

Department of Justice (Law Enforcement Assistance Administration)

Term and Scale of Effort: 8/75 – 6/76; 1.3 person years

Principal Investigator: Dale R. Mann

Dangerous, hardcore offenders make up a very small percentage of all the youths that violate the law. They are, however, the focal point of the juvenile problem today. Over the past 10 years, arrests of juveniles for crimes of violence (homicide, rape, robbery, and aggravated assault) have increased almost 70 percent on a national level. Rand assessed the value of existing intervention techniques in dealing with dangerous juvenile offenders, and attempted to determine the potential value of intervention approaches in current use elsewhere but not yet tried with this category of offender. The research aimed to assist the National Institute of Juvenile Justice and Delinquency Prevention in planning its future research and demonstration program.

R-1930-DOJ, *Intervening with Convicted Serious Juvenile Offenders*, D. Mann, July 1976.

CITIZEN PATROL EVALUATION

Department of Justice (Law Enforcement Assistance Administration)

Term and Scale of Effort: 6/75 – 2/76; 1.6 person years

Principal Investigator: Robert K. Yin

In the face of rising crime and a reduced sense of safety during the 1960s and early 1970s, urban residents initiated auxiliary patrol efforts to supplement municipal police service. Foremost among citizen concerns was the gap between existing law enforcement resources and citizen needs for service—a gap widened by the civil disorders of the 1960s and the resulting decline in police-community relations. This study described citizen patrol projects in current use and developed research procedures for assessing their impact.

R-1912-DOJ, *Patrolling the Neighborhood Beat: Residents and Residential Security*, R. K. Yin, M. E. Vogel, J. M. Chaiken, and D. Both, March 1976.

R-1912/1-DOJ, *Patrolling the Neighborhood Beat: Residents and Residential Security. Executive Summary*, R. K. Yin, M. E. Vogel, J. M. Chaiken, and D. Both, March 1976.

R-1912/2-DOJ, *Patrolling the Neighborhood Beat: Residents and Residential Security—Case Studies and Profiles*, R. K. Yin, M. E. Vogel, J. M. Chaiken, and D. Both, March 1976.

REVIEW OF CRIMINAL JUSTICE MODELS

Department of Justice (Law Enforcement Assistance Administration)

Term and Scale of Effort: 8/74 - 10/75; 3.8 person years

Principal Investigators: Jan M. Chaiken and Leo P. Holliday

A large number of computer-operated models have been created to simulate the overall criminal justice system, police deployment and allocation, police patrol activities, and the flow of defendants through courts and correctional institutions. Rand staff reviewed these models to produce an anthology of the most serviceable ones for use in a textbook for criminal justice planners. In the case of models for patrol car allocation, staff designed and documented a new program that included the best features of the existing ones. The text describes the capabilities of the models and provides mathematical and programming detail.

R-1786/1-HUD/DOJ, *Patrol Car Allocation Model: Executive Summary*, J. M. Chaiken and P. Dormont, September 1975.

R-1786/2-HUD/DOJ, *Patrol Car Allocation Model: User's Manual*, J. M. Chaiken and P. Dormont, September 1975.

R-1786/3-HUD/DOJ, *Patrol Car Allocation Model: Program Description*, J. M. Chaiken and P. Dormont, September 1975.

R-1859-DOJ, *Criminal Justice Models: An Overview*, J. M. Chaiken, T. B. Crabill, L. P. Holliday, D. L. Jaquette, M. Lawless, and E. S. Quade, October 1975.

"Summary of Operational Criminal Justice Models," J. M. Chaiken, T. Crabill, L. P. Holliday, D. L. Jaquette, M. Lawless, and E. S. Quade, in S. Nagel (ed.), *Modeling the Criminal Justice System*, Sage Publications, 1977.

PERFORMANCE MEASURES IN THE CRIMINAL PROSECUTION AND ADJUDICATION PROCESS

Department of Justice (Law Enforcement Assistance Administration)

Term and Scale of Effort: 7/74 - 7/76; 5.7 person years

Principal Investigator: Sorrel Wildhorn

The activities records typically maintained by prosecution agencies and courts are adequate for making detailed reviews of individual cases or arriving at overall measures of total cost and workload, but they are not readily converted to measures of performance, cost-effectiveness, quality of justice dispensed, or impact on crime levels and recidivism in a given jurisdiction. Rand developed and tested a collection of measures of fairness, quality, and efficiency in the performance of criminal courts and prosecution agencies throughout the country. Evaluations were arrived at, in part, from interviews conducted with criminal justice personnel (judges, prosecutors, defense attorneys, court administrators), victims, witnesses, defendants, and the general public.

R-1917-DOJ, *Indicators of Justice: Measuring the Performance of Prosecution, Defense, and Court agencies involved in Felony Proceedings (A Guide to Practitioners)*, S. Wildhorn, M. Lavin, and A. H. Pascal, June 1976.

R-1918, *Indicators of Justice: Measuring the Performance of Prosecution, Defense, and Court Agencies Involved in Felony Proceedings: Analysis and Demonstration*, S. Wildhorn et al., June 1976.

Indicators of Justice: Measuring the Performance of Prosecution, Defense, and Court Agencies Involved in Felony Proceedings, S. Wildhorn, M. Lavin, and A. H. Pascal, D. C. Heath and Company, 1977.

AN ANALYSIS OF THE CRIMINAL INVESTIGATION PROCESS

Department of Justice (National Institute of Law Enforcement and Criminal Justice)

Term and Scale of Effort: 7/73 - 11/75; 8 person years

Principal Investigators: Peter W. Greenwood and Sorrel Wildhorn

Rand surveyed investigative organizations within municipal police departments and county sheriffs' offices to determine the relative strengths and weaknesses of their varying organizational modes, decisionmaking processes, and patterns of resource allocation. The research focused on the methods of dealing with the most common high-incidence street crimes—burglary, robbery, assault, and drug crimes—and how to make those methods more effective.

R-1776-DOJ, *The Criminal Investigation Process: Vol. I, Summary and Policy Implications*, P. W. Greenwood and J. Petersilia, October 1975.

R-1777-DOJ, *The Criminal Investigation Process: Vol. II, Survery of Municipal and County Police Departments*, J. M. Chaiken, October 1975.

R-1778-DOJ, *The Criminal Investigation Process: Vol. III, Observations and Analysis*, P. W. Greenwood, J. M. Chaiken, J. Petersilia, and L. L. Prusoff, October 1975.

The Criminal Investigation Process (based on R-1776, R-1777, and R-1778). P. W. Greenwood, J. M. Chaiken, and J. Petersilia, D. C. Heath and Company, 1977.

"The Criminal Investigation Process: A Summary Report," J. M. Chaiken, P. W. Greenwood, and J. Petersilia, *Policy Analysis*, Vol. 3, No. 2, Spring 1977.

MANAGEMENT POLICIES OF THE LOS ANGELES DISTRICT ATTORNEY'S OFFICE

Department of Justice (Law Enforcement Assistance Administration)

Term and Scale of Effort: 7/71 - 1/73; 1.7 person years

Principal Investigator: Peter W. Greenwood

The Los Angeles District Attorney's Office is the largest in the world, serving over 77 incorporated cities and 50 police agencies. Like other prosecutorial agencies, it faces growing caseloads, the need to deal with rapid changes in the law, and other management and information problems. At the District Attorney's request, Rand surveyed the office's procedures to determine how productivity could be increased.

R-1127-DOJ, *Prosecution of Adult Felony Defendants in Los Angeles County: A Policy Perspective*, P. W. Greenwood, S. Wildhorn, E. C. Poggio, M. J. Strumwasser, and P. deLeon, March 1973.

Prosecution of Adult Felony Defendants: A Policy Perspective, P. W. Greenwood, S. Wildhorn, E. C. Poggio, M. J. Strumwasser, and P. deLeon, D. C. Heath and Company, 1976.

PRIVATE AND AUXILIARY PUBLIC POLICE IN THE UNITED STATES

Department of Justice (National Institute of Law Enforcement and Criminal Justice)

Term and Scale of Effort: 7/70 - 12/71; 4.5 person years

Principal Investigator: Sorrel Wildhorn

In this study Rand staff described the nature and extent of the private police industry in the United States, its problems, its present regulation, and how the law impinges on it. The benefits, costs, and risks to society of current

private security were evaluated and a preliminary policy and statutory guidelines for improving its future operations and regulation were developed for NILECJ use. The results of the study were used by the private police industry, the governmental agencies that regulate it, and the general public.

R-869-DOJ, *Private Police in the United States: Findings and Recommendations*, J. S. Kakalik and S. Wildhorn, December 1971.

R-870-DOJ, *The Private Police Industry: Its Nature and Extent*, J. S. Kakalik and S. Wildhorn, December 1971.

R-871-DOJ, *Current Regulation of Private Police: Regulatory Agency Experience and Views*, J. S. Kakalik and S. Wildhorn, December 1971.

R-872-DOJ, *The Law and Private Police*, J. S. Kakalik and S. Wildhorn, December 1971.

R-873-DOJ, *Special-Purpose Public Police*, J. S. Kakalik and S. Wildhorn, December 1971.

The Private Police: Security and Danger, J. S. Kakalik and S. Wildhorn, Crane, Russak and Company, Inc., 1976.

EDUCATION AND HUMAN RESOURCES

Richard Shavelson, Program Director

Rand established the Education and Human Resources Program to help improve the quality of information available to federal, state, and local policymakers. The program seeks to advance the broadly held public objective of education and human resources policy: overcoming poverty and inequality. Starting from that premise, Rand takes an objective approach to analyzing the implementation, costs, and effectiveness of government programs.

Rand's education and human resources research is concerned with several broad problems: identifying the needs of disadvantaged groups; weighing tradeoffs between public and private methods of responding to those needs; reviewing alternative methods of funding and regulating public services; gaining insights into the problems of federal-state-local relationships; improving the performance of school districts, schools, and human service agencies; and evaluating the effects of education and human resources programs on the intended beneficiaries.

Rand's work is supported by government agencies and foundations concerned with education and human resources issues. Most of the projects are conducted in response to requests for analyses of specific programs or policy choices. Some, however, are defined more broadly, inquiring into the capacity and limits of policy instruments available to different levels of government, or to the public sector in general.

Rand's work is widely read by policymakers in the Congress, by state legislators, and by members of public service agencies at all levels of government. Through the Education Policy Research Center, the program has a direct link to the policy deliberations of the U.S. Department of Education and the Congressional committees that oversee it.

John Pincus headed the Education and Human Resources Program from its inception in the late 1960s until 1979. Paul Hill served from April of 1979 until October 1980; Richard Shavelson became Program Director in October 1980.

EDUCATION

SCHOOL FINANCE AND GOVERNANCE

COMPARATIVE STUDY OF THE MANAGEMENT SYSTEM OF MAJOR FEDERAL EDUCATION PROGRAMS

National Institute of Education

Term and Scale of Effort: 6/80 - 1/82; 1.5 person years

Principal Investigator: Paul T. Hill

A recently completed study of the federal administration of ESEA Title I (compensatory education) concluded that federal influence over school districts is based primarily on techniques of informal political pressure, and not, as is generally believed, on formal enforcement processes. The finding is important because it means that elements of the formal enforcement system should be evaluated for their contribution to the federal government's ability to exert pressure on behalf of program objectives, rather than (as now) to the government's ability to prosecute offenders in formal quasi-judicial proceedings. It also means that federal management is effectively limited to producing subtle changes in local priorities; in Title I, at least, the federal government cannot hope to exercise fine quantitative control over local service delivery.

Using case studies, the research will extend the lines of analysis developed for Title I to the education of handicapped children and the implementaion of federal civil rights guarantees. This comparison of the management systems used by three federal education programs to affect state and local education policy will provide an understanding of the tools available to the federal government for managing its education programs.

Although major policy decisions regarding preventive medicine might be made before the work is concluded, the results will nevertheless be of considerable value because major federal programs, the needs of the population and priorities of decisionmakers change. New insights about preventive medicine should enhance future public decisions, even if only to modify past positions.

ROLE OF THE STATES IN IMPLEMENTING FEDERAL EDUCATION POLICY

National Institute of Education

Term and Scale of Effort: 4/80 - 4/81; 1.5 person years

Principal Investigators: Milbrey W. McLaughlin and Lorraine M. McDonnell

Federal grant programs to state governments have increased markedly in the last 50 years. At present more than 20 federal education programs channel

funds to local school districts through the states, with all levels of government playing important roles in policy implementation.

Students of federalism have long recognized the importance of these grant programs in linking federal and state governments with each other and, in turn, with local governments.

Recently, however, both policymakers and social scientists have questioned the overall effectiveness of such programs. Unfortunately, there are few studies of the state role in implementing federal policy. This study begins to correct this deficiency by examining the state role in implementing federal education policy. Although it focuses on education, much of the analysis also applies to other domestic policy areas where a federal-state relationship has been formed through grant programs.

Project staff will use detailed case studies of the factors affecting state level response to federal education programs in four states. Two basic dimensions of federal policy implementation will be analyzed: compliance behavior (the extent to which states actually adhere to federal program regulations) and programmatic development (the ways in which federal policy goals have been made operational by states).

EDUCATION POLICY RESEARCH CENTER

Department of Education (Assistant Secretary for Planning and Budget)

Term and Scale of Effort: 12/75 – 10/82; 36.0 person years

Principal Investigator: Paul T. Hill

Rand's Education Policy Research Center assists the U.S. Department of Education by conducting research on federal education policy. Under two consecutive three year contracts, the center has studied the effect of existing federal programs, documented the need for changes in programs, and analyzed pending proposals. In previous years, the center has:

- Examined alternative rationales for federal activity in financing elementary and secondary education.
- Assessed the implications of recent court cases affecting school finance and governance.
- Estimated the current and future fiscal capacity of state and local educational systems.
- Examined the influence of changing demographic patterns on school finance systems.
- Designed improved plans for equalizing resources among and within states.
- Analyzed local school district response to federal and state education grants.
- Discussed the impact of collective bargaining on educational policymaking and spending.

- Studied alternative federal incentives for state education finance reform.
- Examined the finance and governance of educational services for handicapped children.
- Provided a comprehensive analysis of the planning, conduct, and reporting of the evaluation studies of federal education programs.
- Examined the management resources available to the administrations of federal categorical grant programs, and assessed whether alternative procedures and resource uses can be more effective.
- Identified the major problems that federal aid creates for rural areas, and recommended changes in these policies that might make federal programs more responsive to the needs of rural schools.

Examples of work now underway are:

- *Interactions Among Federal Education Programs.* Since 1965, the number of federal programs and regulations affecting the schools has gone from one to several dozen, straining the administrative and financial capacity of local school districts. The Center will conduct a pilot study to assess the scope and seriousness of interference among these federal education programs.
- *The Effects of Federal Education Programs on School Principals.* At the request of the Secretary of Education, Rand has made a small exploratory study of the administrative burdens imposed on school principals by federal programs.
- *Alternative Federal Roles in Education.* Congress plans to conduct a general review of federal program strategies in education in 1982. As background, Rand will produce a synthesis of research findings on the problems of existing federal programs, the likely difficulties of implementing alternative federal programming strategies, and possible new divisions of labor between federal and state and local education agencies in monitoring, enforcing, and providing technical assistance.
- *States' Use of Funds for the Education of Handicapped Children.* Rand is conducting case studies in nine states to analyze the processes by which federal funds for educating handicapped children are distributed and the resulting allocation to school districts.
- *Problems of Maintenance of Effort Requirements.* As a precondition for receiving funds under federal education programs, school districts must maintain levels of expenditures from their own sources. Failing this, they must be denied federal funds. Rand is reviewing the maintenance-of-effort provisions of various federal education programs, and matching them against projected local spending patterns in several states, to assess the seriousness of the problem.

- *The Costs of Federal Requirements for Language Minority Education.* The federal government is issuing new regulations defining school districts' obligations for identifying and serving language minority children. The Center is conducting a three-year study of the implementation of the bilingual regulations. There is great uncertainty about how much the new federal requirements governing the education of language minority pupils will cost. The U.S. Department of Education has asked the Center to conduct an empirical study of the likely cost of the new requirements.

R-2224-HEW, *The Courts as Educational Policymakers and Their Impact on Federal Programs.* B. Levin, August 1977.

R-2407-NIE, *Organized Teachers in American Schools,* L. M. McDonnell and A. H. Pascal, February 1979.

R-2392-NIE/HEW, *The Search for Equity in School Finance: Michigan School District Response to a Guaranteed Tax Base,* R. E. Park and S. J. Carroll, March 1979.

R-2393-NIE/HEW, *The Search for Equity in School Finance: Michigan School District Response to a Guaranteed Tax Base,* R. E. Park and S. J. Carroll, March 1979.

R-2583-NIE, *Federal Aid to Rural Schools: Current Patterns and Unmet Needs,* G. V. Bass and P. Berman, December 1979.

R-2485-HEW, *Mechanisms for the Implementation of Civil Rights Guarantees by Educational Institutions.* P. T. Hill and R. A. Rettig, January 1980.

R-2517-NIE, *The Financial Health of Teacher Retirement Systems,* R. B. Victor, October 1980.

R-2638-ED, *The Aggregate Effects of Federal Education Programs,* J. M. Kimbrough and P. T. Hill, forthcoming.

R-2683-ED, *Economics of Public School Finance,* A. Gurwitz, forthcoming.

N-1237-HEW, *Funding Mechanisms and Their Effects on Rural Areas: Analysis of Two Federal Programs,* G. V. Bass and P. Berman, July 1979.

N-1232-HEW, *Enforcement and Informal Pressure in the Management of Federal Categorical Programs in Education,* P. T. Hill, August 1979.

N-1262-HEW, *Interrelationships of Federal Programs for Education of Handicapped Children,* J. S. Kakalik, August 1979.

N-1290-HEW, *An Improved Strategy for Evaluating Federal Programs in Education,* T. K. Glennan, Jr., and S. E. Berryman, August 1979.

N-1467-HEW, *The Effects of Federal Education Programs on School Principals,* P. T. Hill, J. M. Wuchitech, and R. C. Williams, February 1980.

N-1504-ED, *Findings of a Seminar on the Cost of Bilingual Education,* P. Carpenter-Huffman, July 1980.

N-1561-ED, *State Allocation and Management of P.L. 94-142 Funds*, M. A. Thomas, forthcoming.

The Federal Interest in Financing Schooling, P. M. Timpane, Ballinger, 1978.

SURVEY OF SPECIAL EDUCATION SERVICES

Department of Education (Office of Special Education)

Term and Scale of Effort: 10/79 - 12/80; 3.5 person years

Principal Investigator: William S. Furry

Since 1975, when the Education for All Handicapped Children Act (P.L. 94-142) was passed, the federal role in providing basic service support for special education has grown rapidly. In 1977, federal programs directly supporting the education of handicapped youth totalled approximately $450 million; in 1980, this total will approach $1 billion. The federal government has also significantly increased its role in shaping the special education delivery system through mandates that (1) all handicapped children be identified and provided a free appropriate public education; (2) individualized education programs be provided for each student; (3) services be provided in the least restrictive environment; and (4) due process procedures concerning student programs be implemented.

This study aims at providing accurate, current information on the special education and related services provided to handicapped children in a nationally representative sample of localities. It will supply data on the quantity and types of services provided to physically and mentally handicapped children, in four age groups between birth and 21, who are served in a variety of educational placements ranging from regular classes to residential schools. It will also examine local organizational arrangements for delivering special education services and the extent to which delivery has been affected by the existence or absence of various cooperative arrangements and interagency agreements. Finally, the study will produce information on the response of the nation's school systems to the federal mandates mentioned above by comparing the inventory of special education and related services for 1980-1981 with a similar inventory in the same localities that was made in 1977-1978.

SPECIAL EDUCATION FINANCIAL AND PROGRAM POLICIES

Department of Education (Assistant Secretary for Special Education and Rehabilitative Services)

Term and Scale of Effort: 10/79 – 4/81; 4 person years

Principal Investigator: James S. Kakalik

How much money will be needed over the next decade to provide an appropriate special education for all handicapped children? What can be done to ensure a reasonable level of funding per child for such education?

Project staff have developed a major new national data base (including cost information) on state and local special education programs. The data base was used for three purposes: (1) projecting the expenditures required to provide special education to all handicapped children, (2) analyzing local and state variations in the cost of special education for the purpose of learning what funding policies might provide a reasonable level of funding per child in various situations, and (3) disseminating information on the costs of special education and related services which can be used by education agency personnel and others concerned with financing and administering special education programs.

A PRIMER ON THE ECONOMICS OF SCHOOL FINANCE REFORM

National Institute of Education

Term and Scale of Effort: 8/79 – 8/80; .4 person years

Principal Investigator: Aaron S. Gurwitz

The project produced a monograph explaining the basic principles of microeconomic theory as it relates to the desirability and design of school finance reform. The monograph is intended to improve educators' understanding of the economic analysis of state and local public finance.

Current discussions of school finance reform take place without reference to important findings of economic analysis, though such findings are well known to economists. As a result, the reform proposals designed by school finance specialists and adopted by well-intentioned legislatures may produce outcomes directly contrary to what had been intended. By facilitating communication between economists and non-economists involved in school finance reform, the monograph should help to minimize such misunderstandings.

R-2648-ED, *The Economics of Public School Finance*, A. Gurwitz, forthcoming.

THE POLITICS OF SCHOOL FINANCE IN CALIFORNIA: REFORM AND RETRENCHMENT

The Ford Foundation and the National Institute of Education

Term and Scale of Effort: 8/78 – 1/81; 2 person years

Principal Investigator: Milbrey W. McLaughlin

Since San Antonio vs. Rodriguez (1973), in which the U.S. Supreme Court held that the federal constitution did not offer a remedy for complaints against the inequity of state school financing systems, school finance reform has been entirely a matter of state policy. Because there are many different solutions, a close examination of reform politics, on a state-by-state basis, is the only way at present to accumulate knowledge of school finance reform.

The central focus of this project is on coalition politics: how reform coalitions are constructed, how bargaining occurs among competing political interests in the formulation of a reform package, and how dramatic changes in the political environment affect coalition politics. The analysis centers on Assembly Bill 65, an omnibus finance and governance measure passed in 1977, and its antecedents—notably Senate Bill 90 (1973) and AB 1267 (1973)—and on the effect of property tax limitations imposed by Proposition 13 on AB 65's reform provisions. An important subtheme of the research is the process of finding politically feasible solutions to the technical problems posed by education finance: equity of tax expenditure, cost differential of urban districts, use of categorical programs to supplement basic state aid, and determination of the state's share of school funding.

TEACHER RETIREMENT FUNDS STUDY

National Institute of Education

Term and Scale of Effort: 10/78 – 9/79; 1 person year

Principal Investigator: Richard B. Victor

Public attention is beginning to focus on the financial condition of retirement funds for state and local government employees. Public employers and taxpayers are becoming aware of the future burden of large, unfunded liabilities; public employees and their unions are questioning the security of retirement benefits; and the federal government is contemplating the regulation of public retirement systems. This study provides a description of the retirement systems of teachers. Staff studied the financial health of these systems and explored research and data necessary for an understanding of the effects of various benefit and financing parameters on the cost of education, intergenerational and interjurisdictional transfers, the fiscal condition of localities, and the integrity of benefits.

R-2517-NIE, *The Financial Condition of Teacher Retirement Systems*, R. B. Victor, forthcoming.

N-1519-NIE, *The Characteristics of Teacher Retirement Systems*, S. Pease, forthcoming.

CAPITALIZATION OF SCHOOL FINANCE REFORM

The Ford Foundation

Term and Scale of Effort: 8/78 – 1/80; 1 person year

Principal Investigator: Aaron S. Gurwitz

This study examined the interaction of tax capitalization (the phenomenon by which property values are affected by local taxes and expenditures) and school finance reform. Staff sought answers to the questions: "Can we safely ignore the phenomenon of recapitalization when designing new school finance systems?" and "Are the distributive effects of recapitalization relevant and, if so, are they desirable or undesirable?"

N-1312-FF, *School Finance Capitalization*, A. Gurwitz, January 1980.

THE EFFECT OF TEACHER COLLECTIVE BARGAINING ON SCHOOL DISTRICT ORGANIZATION AND GOVERNANCE

National Institute of Education

Term and Scale of Effort: 1/78 – 4/79; 1.8 person years

Principal Investigators: Anthony H. Pascal and Lorraine M. McDonnell

Past research on teacher collective bargaining has focused primarily on wages and fringe benefits. This two-phase study addresses other issues that have largely been ignored, including national trends in the noncompensation portions of teacher contracts and the effect of teacher collective bargaining on school and district level decisionmaking.

During Phase I, project staff examined a national sample of 151 teacher contracts to determine what types of noncompensation provisions are included in contracts and how they differ over time and across types of school districts.

In Phase II, staff conducted fieldwork in fifteen local districts in order to understand the nature of the negotiations process itself, how contractual provisions are implemented, and the role of political action as a supplement to collective bargaining.

R-2407-NIE, *Organized Teachers in American Schools*, L. M. McDonnell and A. H. Pascal, February 1979.

"Organized Teachers and Local Schools," L. M. McDonnell and A. H. Pascal, in M. F. Williams (ed.), *Government in the Classroom*, Special Edition of Proceedings of the Academy of Political Science, October 1978.

"A New Power Elite? Collective Bargaining and Teacher Organizations," A. H. Pascal and L. M. McDonnell, *Proceedings of the American Academy of Political Science*, October 1978.

"National Trends in Teacher Collective Bargaining," L. M. McDonnell and A. H. Pascal, *Education and Urban Society*, February 1979.

"The Hidden Costs of Collective Bargaining in Local Government," A. H. Pascal, *Taxing and Spending*, Spring 1980.

A STUDY OF ESEA TITLE IV CONSOLIDATION

Office of Education

Term and Scale of Effort: 10/77 – 3/80; 9.2 person years

Principal Investigator: Milbrey W. McLaughlin

The process of providing federal aid to schools has been criticized by both state and local officials ever since the federal government expanded its commitment to elementary and secondary education in the mid-1960s. Excessive red tape, meaningless regulations, and "federal attempts to control school district policy" are frequent charges made by state and local administrators.

In 1974 Congress amended Title IV of the Elementary and Secondary Education Act of 1965 (ESEA). This amendment sought to restructure the federal school aid process to reduce the administrative burden of federal programs and give state and local authorities increased autonomy and flexibility in allocating the amended funds. This study was the first attempt to systematically assess the effects of Title IV on state and local management practices, and program operations. It also provided an opportunity to examine the implications of the revisions to Title IV for other federal education programs.

R-2531-HEW. *Program Consolidation and the State Role in ESEA Title IV*, M. W. McLaughlin and L. M. McDonnell, with the assistance of M. A. Cox, R. F. Elmore, C. Myers, and G. L. Zellman, April 1980.

THE COST OF SPECIAL EDUCATION

Department of Education (Office of Special Education)

Term and Scale of Effort: 7/77 – 4/80; 8.4 person years

Principal Investigator: James S. Kakalik

No one really knows how much various types of special education cost. This lack of information makes it extremely difficult to plan services for

individuals, prepare budgets, and make policy decisions involving the tradeoffs of costs and effects of different services and different means of providing those services. This research involved cost data collection, modeling, and analysis to improve decisionmaking on special education programming and finance. Accurate and current information was provided on the costs of various alternative types of educational placements for children of different ages with various physical and mental handicaps. This study also produced improved cost analysis methods and models for use by education agency personnel and others concerned with financing and administering special education programs.

N-1511-ED, *The Cost of Special Education: Description of Data Files*, J. S. Kakalik, W. S. Furry, M. A. Thomas, M. F. Carney, and G. Gay, June 1980.

SCHOOL FINANCE REFORM

National Institute of Education

Term and Scale of Effort: 10/76 – 5/79; 3.4 person years

Principal Investigator: Stephen J. Carroll

In recent years, there have been significant reforms in the educational financing systems of at least 20 states, primarily directed toward reducing the wide interdistrict disparity in school spending permitted by the established state systems. Rand staff analyzed the effects of recent reforms in five states whose new finance laws represent the major approaches taken. Through a detailed analysis of the effects of reform within the individual states, as well as a comparative analysis of the strengths and weaknesses of the different approaches adopted, the study provides useful information to officials in states that have yet to undertake or complete their reforms and to federal officials with responsibilities in the area of school finance.

R-2348-NIE, *The Search for Equity in School Finance: Results from 5 States*, S. J. Carroll, M. A. Cox, and W. Lisowski, March 1979.

R-2393-NIE, *The Search for Equity in School Finance: Michigan School District Response to a Guaranteed Tax Base*, R. E. Park and S. J. Carroll, March 1979.

R-2420-1-NIE, *The Search for Equity in School Finance: Summary and Conclusions*, S. J. Carroll, March 1979.

"The Results of School Finance Reform in Five States," S. J. Carroll, in T. Geske and W. McMahon (eds.), *Efficiency and Equity in School Finance*, Allyn and Bacon, forthcoming.

AN ECONOMETRIC ANALYSIS OF SCHOOL DISTRICT BEHAVIOR IN ALLOCATING BUDGETS AMONG RESOURCE INPUTS

National Institute of Education

Term and Scale of Effort: 7/73 - 12/74; 1 person year

Principal Investigator: Stephen M. Barro

One of the major unknowns in evaluating proposed changes in state or federal school finance systems is how local public school districts would respond to changes in funding: What additional resources would they purchase if budgets were increased? What expenditures would be curtailed if budgets were cut? To answer these questions, Rand developed an econometric model of school district behavior in allocating funds among major categories of school resources. The model, which was developed from Michigan and California data, focuses on trade-offs among staffing ratios, staff qualifications, level of salary schedules, and nonstaff resources. It is intended for use by policymakers considering changes in school finance formulas or in institutional arrangements for school district budgetmaking.

R-1797-NIE, *Budget Allocation by School Districts: An Analysis of Spending for Teachers and Other Resources*, S. M. Barro and S. J. Carroll, December 1975.

FINANCIAL AND EDUCATIONAL IMPLICATIONS OF THE SERRANO DECISION

The Ford Foundation

Term and Scale of Effort: 2/72 - 2/73; 3 person years

Principal Investigator: Arthur J. Alexander

The Supreme Court of California in Serrano vs. Priest concluded that the California system of school financing violates the equal protection clauses of the U.S. and California constitutions because it makes the quality of education in each school district a function of district wealth. Since most other states use the same system, the decision has implications for the financing, organization, management, and quality of public education nationwide. Rand surveyed means of complying with the Serrano decision, analyzed the fiscal and organizational implications of alternative means of compliance, estimated the impact of fiscal reform on the demand for teachers and on teacher salaries, and investigated the possibility of a taxpayer revolt.

R-1440-FF, *Inequality in California School Finance: Dimensions, Sources, Remedies*, A. J. Alexander, March 1975.

R-1465-FF, *Schools, Taxes, and Voter Behavior: An Analysis of School District Property Tax Elections*, A. J. Alexander and G. V. Bass, April 1974.

R-1588-FF, *Teachers, Salaries, and School District Expenditures*, A. J. Alexander, October 1974.

School Finance in Transition: The Courts and Educational Reform, J. Pincus (ed.), Ballinger Publishing Company, 1974.

ANALYSIS OF THE U.S. EDUCATIONAL PERSONNEL SYSTEM

Office of Education

Term and Scale of Effort: 6/71 – 6/74; 5.4 person years

Principal Investigator: Stephen J. Carroll

The educational personnel system in the U.S. comprises three million people, 16,000 state and local educational agencies, and numerous federal agencies. As school enrollments level off, the dynamics of this massive system will change. Rand analyzed the factors determining the market for teachers and projected the probable future size of the teacher surplus.

R-1071-HEW, *Analysis of the Educational Personnel System: I, Teacher Mobility in San Diego*, D. H. Greenberg and J. J. McCall, January 1973.

R-1270-HEW, *Analysis of the Educational Personnel System: II, A Theory of Labor Mobility with Applications to the Teacher Market*, D. H. Greenberg and J. J. McCall, August 1973.

R-1308-HEW, *Analysis of the Educational Personnel System: III, The Demand for Educational Professionals*, S. J. Carroll, October 1973.

R-1325-HEW, *Analysis of the Educational Personnel System: IV, Teacher Turnover*, E. B. Keeler, October 1973.

R-1341-HEW, *Analysis of the Educational Personnel System: V, The Supply of Elementary and Secondary Teachers*, S. J. Carroll and K. F. Ryder, February 1974.

R-1342-HEW, *Analysis of the Educational Personnel System: VI, Staffing Patterns in U.S. Local Public Schools*, K. F. Ryder and B. M. Juba, February 1974.

R-1343-HEW, *Analysis of the Educational Personnel System: VII, Teacher Mobility in Michigan*, D. H. Greenberg and J. J. McCall, February 1974.

R-1344-HEW, *Analysis of the Educational Personnel System: VIII, The Market for Teachers*, S. J. Carroll, February 1974.

EVALUATION OF EDUCATIONAL PROGRAMS AND INNOVATIONS

A CONCEPTUAL FRAMEWORK FOR THE ANALYSIS OF STAFF DEVELOPMENT

National Institute of Education

Term and Scale of Effort: 10/79 - 1/81; 1 person year

Principal Investigator: Daniel M. Weiler

Public education systems are widely held to be immune to all but incremental or marginal improvements. Recent studies concluded that most school systems are probably even more resistant to change than has been assumed. This condition could result from the structure and process of American education, which creates an environment where teachers and administrators have inadequate incentives to adopt new practices, experiment with new procedures, or seek to improve their professional skills.

Staff are creating a model for analyzing the professional development of education personnel through an analytic synthesis of the literature on motivation and incentives, and selected policies. A preliminary literature review indicated that such a synthesis did not exist. The study has three complementary objectives: (1) it suggests what staff development activities could be successful, given the present incentives of most school districts; (2) it indicates what structural changes are desirable to improve these incentives; and (3) it provides a method for testing these ideas and for evaluating staff development programs.

EMPLOYMENT PREPARATION ACTIVITIES IN THE EDUCATIONAL PROGRAM

Department of Health, Education, and Welfare (Assistant Secretary for Planning and Evaluation)

Term and Scale of Effort: 7/79 - 3/80; .1 person years

Principal Investigator: Sue E. Berryman

The Congressional reauthorization debate on the Vocational Education Act is scheduled for 1981. To help the executive branch prepare for the debate, Rand staff wrote a paper for the Aspen Workshop on Vocational Education policies. The paper used extant data, including data from three longitudinal surveys of high school students, to assess four questions: (1) Considering their placement abilities and preferences, are students misassigned to the three high school curricula? Do the three curricula have different effects on students who start out with the same abilities and preferences? (2) Are high school resources organized in a way that encourages vocational students to stay in school and finish? (3) What work-establishment payoffs should we expect from

vocational education, in light of employers' hiring practices and the realities of life on the job? (4) What work-establishment benefits does vocational education offer to three youth subgroups with particular labor market problems: high school dropouts (effects on high school completion), noncollege females (effects on occupational desegregation by sex), and noncollege blacks (employment effects)?

N-1475-ASC, *Vocational Education and the Work Establishment of Youth: Equity and Effectiveness Issues*, S. E. Berryman, June 1980.

A MONOGRAPH ON EDUCATIONAL CHANGE

National Institute of Education and Rand-Sponsored Research

Term and Scale of Effort: 6/79 – 12/80; 1 person year

Principal Investigator: Paul Berman

How do school districts introduce, implement and sustain change? What factors affect the local change process and its educational outcomes? What outside strategies can be used to influence the local change process and improve educational outcome? The project will address these and similar issues through a review of Rand's previous relevant work and related literature.

TEACHERS LOOK AT EDUCATIONAL POLICIES

The Ford Foundation

Term and Scale of Effort: 6/79 – 6/81; 2.4 person years

Principal Investigators: Arthur E. Wise and Linda Darling-Hammond

Many educational policies that are salient to policymakers are considered irrelevant or worse by teachers. This project will interview 50 teachers drawn from several school districts. The major objective of the work is to compare the image of education held by legislatures and courts with the image of education held by teachers. The study's objectives are:

- To develop a "teacher's-eye view" of such policies as minimum competency testing.
- To compare policymakers' and teachers' views of how to improve education.
- To identify, if possible, concepts of teaching that are relevant to the needs of both policymakers and teachers.

YOUTH, PREGNANCY, AND PARENTHOOD: THE EDUCATIONAL IMPLICATIONS

National Institute of Education

Term and Scale of Effort: 11/78 – 5/81; 2.8 person years

Principal Investigator: Gail L. Zellman

As more of the adolescent population has become sexually active, exposure to the risk of pregnancy has increased. Adolescents are becoming parents at ever younger ages and, increasingly, outside of marriage. Whether outside or within marriage, early parenthood reduces the adolescent's life-chances, restricting career options and educational attainment. This study examines the role currently played by school policies and programs in encouraging pregnant students and parents to continue their education. The research has three major objectives:

- To determine how pregnant junior and senior high school students decide whether to drop out of school, to marry, or to continue in school without significant interruption.
- To assess the role of the schools in the decision of pregnant students to continue in school.
- To determine whether the formal and informal policies and programs of some schools help to reduce dropout rates, thereby mitigating the long-term damage of early pregnancy and parenthood.

LOCAL ADMINISTRATIVE PROCESSES AS FEDERAL MANAGEMENT TOOLS IN IMPLEMENTING CIVIL RIGHTS GUARANTEES

Department of Health, Education, and Welfare (Assistant Secretary for Planning and Evaluation)

Term and Scale of Effort: 8/78 – 9/79; 2.3 person years

Principal Investigator: Paul T. Hill

The Office of Civil Rights (OCR) promotes compliance with federal guarantees against discrimination on grounds of race, sex, and handicap by agencies receiving HEW funds. To increase voluntary compliance, OCR has mandated four administrative processes: filing formal assurance of compliance forms, conducting agency self-evaluations, establishing a formal grievance procedure, and appointing a compliance coordinator. If these administrative processes work, there may be less need for federal enforcement.

This study evaluated the effectiveness of these and similar processes, and provides information for use by HEW in assessing their place in the implementation of civil rights guarantees.

R-2485-HEW, *Mechanisms for the Implementation of Civil Rights Guarantees by Educational Institutions*, P. T. Hill, R. A. Rettig, E. Davila, M. Gwaltney, K. A. Heald, P. Koshel, and M. E. Vogel, January 1980.

IN-SERVICE EDUCATION FOR DESEGREGATED SETTINGS

National Institute of Education

Term and Scale of Effort: 10/78 – 2/80; 4.5 person years

Principal Investigator: Nicelma J. King

Inservice education—the training that teachers and school staff receive as professionals while they are teaching—is one of the desegregation activities almost universally supported by school administrators. Nevertheless, little information exists on the process of inservice education, its subject matter, or its capacity to improve the desegregation process. This research examined the current practice of inservice education in desegregated settings, and the perceptions of inservice participants about the program's effectiveness. Staff identified policies and practices that appear to enhance staff development effectiveness and developed hypotheses for further study.

This work should be useful to federal and state policymakers in determining how resources for inservice education should be allocated, and to school districts planning for desegregation inservice programs.

R-2539-NIE, *Staff Development Programs in Desegregated Settings*, N. J. King, February 1980.

R-2539/1-NIE, *Staff Development Programs in Desegregated Settings: Executive Briefing*, N. J. King, February 1980.

N-1251-HEW, *Inservice Training in Desegregated School Districts: Eastern Region Case Studies*, M. F. Carney (ed.); E. Davila, M. H. Graubard, M. K. Gwaltney, M. Hunter, N. J. King, August 1979.

N-1252-HEW, *Inservice Training in Desegregated School Districts: Midwest Region Case Studies*, M. F. Carney (ed.); E. Davila, R. E. Mahard, B. Osthimer. August 1979.

N-1253-HEW, *Inservice Training in Desegregated School Districts: Western Region Case Studies*, M. F. Carney (ed.); D. D. Carney, M. Hunter, J. B. Hyman, N. J. King, and S. J. Reese, August 1979.

N-1331-NIE, *In Service Education for Desegregation: A Review of the Literature*, M. F. Carney, November 1979.

IMPACT OF ALTERNATIVE DESEGREGATION REMEDIES ON MINORITY ACHIEVEMENT

National Institute of Education

Term and Scale of Effort: 9/78 – 9/80; 2 person years

Principal Investigators: Robert L. Crain and Rita E. Mahard

While review of the literature indicates that white student test scores are rarely affected by desegregation, the literature is unclear on the effects of

desegregation on black student test scores. This research project aimed to clarify the issue by focusing upon the achievement of black students in a desegregation setting. The impact of scores was analyzed over a three-year period. In the first phase of the project, a statistical case-survey analysis was made of the existing studies of black achievement from communities with different types of desegregation plans. Hypotheses were developed and tested in the second phase of the project using data from a large northern school district.

RAND CONFERENCE ON GOVERNMENT REGULATION OF THE PUBLIC SCHOOLS

The Ford Foundation

Term and Scale of Effort: 8/78 - 1/80; .2 person years

Principal Investigator: Arthur E. Wise

This conference disseminated findings from *Legislated Learning: the Bureaucratization of the American Classroom* to approximately 200 participants who represented government agencies, Congress, universities state and local school systems, private research organizations, special interest groups and public interest law firms. Discussants selected represented a cross-section of opinion with regard to the proper role of government in education.

MAKING DESEGREGATED SCHOOLS WORK: HOW SCHOOLS CREATE SOCIAL CLIMATES

The Ford Foundation and Rand-Sponsored Research

Term and Scale of Effort: 2/78 - 1/79; 1 person year

Principal Investigator: Robert L. Crain

Rand conducted a policy-oriented statistical analysis of 200 desegregated southern high schools. It examined the quality of race relations, achievement test scores, and student attitudes in these 200 schools and tried to locate school characteristics which have helped some of these schools to become successful. Analysis showed that attention to the social climate of the school paid considerable dividend—for example, the quality of the extracurricular program and the employment of music, art, drama, and gym teachers affect the quality of race relations and through that the achievement of students on standardized tests.

Making Desegregation Work: How Schools Create Social Climates, R. L. Crain, R. E. Mahard, and R. Narot, forthcoming.

INDUSTRY/EDUCATION COUNCILS: IMPLICATIONS FOR YOUTHS' OCCUPATIONAL CHOICE AND ATTAINMENT

National Institute of Education

Term and Scale of Effort: 8/76 - 11/76; .1 person year

Principal Investigator: Sue E. Berryman

Rand produced a paper for the National Institute of Education which examined the potential effect of industry/education work councils on youth unemployment rates and on the quality of jobs that youth obtain. The paper assumed that such councils would deliver programs of a career-education nature. It used extant data to assess assumptions among some policymakers about the effects of career education on youth unemployment. The paper concluded that the unemployment rates of youth, in the aggregate, are significantly "frictional," and thus are not primarily attributable to socialization failures that career education might affect. Because smaller socialization failures might affect these unemployment rates, however, it nonetheless assessed three other assumptions that underlie career education: that youth are turning away from the work ethic; that youth lack labor market information; and that youth have the wrong work skills. It then identified programs that industry/education work councils could deliver which might reduce the incidence and duration of youth unemployment.

"Reasonable Expectations: Limits on the Promise of Community Councils," S. B. Bobrow, *Industry/Education Community Councils*, NIE Papers in Education and Work, No. 9, National Institute of Education, Department of Health, Education, and Welfare, December 1977.

"Youth Unemployment and Career Education: Reasonable Expectations," S. E. Berryman, *Public Policy*, Vol. 26, No. 1, Winter 1978.

P-5824, *Reasonable Expectations: Limits on the Promise of Community Councils*, S. B. Bobrow, April 1977.

EVALUATION OF THE EMERGENCY SCHOOL AID ACT (ESAA) NONPROFIT ORGANIZATIONS PROGRAM

Office of Education

Term and Scale of Effort: 7/76 - 3/79; 12 person years

Principal Investigators: Stephen Crocker and Jackie M. Kimbrough

Both the Emergency School Assistance Act of 1972 and its predecessor, the Emergency School Assistance Program, authorized grants to community nonprofit organizations to "support the development or implementation of a plan, program or activity" for school desegregation. Community organizations with commitments to desegregation can help generate increased support for schools; but at the same time introducing community organizations into the

process of desegregation may create a number of problems, since these organizations may have needs and goals that conflict with those of their school district. The overall objective of this study is to describe and evaluate the ESAA Nonprofit Organizations program to provide specific direction for improving the program's operations and effectiveness.

R-2312/1-HEW, *An Evaluation of the ESAA-NPO Program, Vol. I: An Analysis of Federal Program Implementation and Funding Procedures*, J. M. Kimbrough and J. B. Hyman, December 1978.

R-2312/2-HEW, *An Evaluation of the ESAA-NPO Program, Vol. II: ESAA-NPO Operations at the Local Level*, S. Crocker, P. W. Sperlich, and L. P. Oliver, June 1978.

R-2312/3-HEW, *An Evaluation of the ESAA-NPO Program, Vol. III: The Role of Community Organizations in Facilitating School Desegregation*, L. M. McDonnell, G. L. Zellman, and S. M. Weatherford, October 1978.

R-2312/4-HEW, *An Evaluation of the ESAA-NPO Program, Vol. IV: Conclusions and Policy Recommendations*, S. Crocker and J. M. Kimbrough. December 1978.

POLICY ISSUES IN SCHOOL DESEGREGATION

The Russell Sage Foundation and Rand-Sponsored Research

Term and Scale of Effort: 1/76 – 10/78; 1.4 person years

Principal Investigator: David J. Armor

Determining the causes and potential means of resolution of the extended local and national controversy over school desegregation policy will require intensive and sustained inquiry. The causes are extremely complex, involving legal, moral, scientific, and political factors; any resolution will therefore require the efforts of diverse groups including lawyers, judges, social scientists, and political leaders. Rand staff compiled and contributed to a series of essays written in an effort to bring the issues into focus and develop an agenda for further inquiry.

"White Flight and the Future of School Segregation," D. J. Armor, in Stephan and Feagin, *School Desegregation, Past, Present and Future*, Plenum, New York, 1980.

On the Courts and School Desegregation, D. J. Armor, forthcoming.

P-5714, *Sociology and School Busing Policy*, D. J. Armor, September 1976.

P-5931, *White Flight, Demographic Transition, and the Future of School Desegregation*, D. J. Armor and D. Schwartzbach, August 1978.

ANALYSIS OF READING PROGRAMS IN LOS ANGELES CITY SCHOOLS

Los Angeles City Unified School District

Term and Scale of Effort: 12/75 – 7/76; 1.5 person years

Principal Investigator: Anthony H. Pascal

For the past few years, the Los Angeles City Unified School District has committed supplementary resources to improve the reading achievement of its elementary students. Although some encouraging changes in reading scores have resulted, particularly in a number of predominantly minority schools, District staff and School Board members have been unable to identify which programs or general school characteristics contributed to one school scoring higher than another. Selecting schools with predominantly minority enrollments, Rand sought to validate measures of reading achievement, pinpoint program or school characteristics responsible for school-to-school variation, and determine whether successful programs could be maintained in the future or implemented in other schools.

R-2007-LAUSD, *Analysis of the School Preferred Reading Program in Selected Los Angeles Minority Schools*, D. J. Armor, P. Conry-Oseguera, M. A. Cox, N. J. King, L. M. McDonnell, A. H. Pascal, E. Pauly, G. L. Zellman, G. C. Sumner, and V. M. Thompson, August 1976.

INTERACTIVE CLASSROOM TELEVISION SYSTEM (ICTS) FOR THE PARTIALLY SIGHTED

Office of Education

Term and Scale of Effort: 2/75 – 5/79; 7.1 person years

Principal Investigator: Samuel M. Genensky

Partially sighted persons differ from normally sighted persons in that they are obliged to cope with their environment with the help of degraded visual information. The degree to which they are successful in doing this depends on how well they succeed in utilizing the visual cues they receive from their environment. Their success further depends on the visual aids available to them and how effectively they can use them. Rand staff designed and built the first Interactive Classroom Television System, permitting a teacher and partially sighted students to be in continuous visual communication with each other. The primary goal of this project was to determine the effect of using ICTSs on the school experience of partially sighted elementary school children in operational settings.

R-2138-HEW, *A Second Generation Interactive Classroom Television System for the Partially Sighted*, S. M. Genensky, H. E. Petersen, R. W. Clewett, and R. I. Yoshimura, June 1977.

R-2395-HEW, *The Impact of Interactive Classroom Television Systems on the Educational Experiences of Severely Visually Impaired Students*, T. K. Bikson, T. H. Bikson, and S. M. Genensky, September 1979.

ANALYSIS OF EMERGENCY SCHOOL ASSISTANCE PROGRAM II EVALUATION DATA

Office of Education

Term and Scale of Effort: 10/74 - 10/75; 1 person year

Principal Investigator: Henry D. Acland

Since 1970, the U.S. Office of Education has been providing funds to school districts to meet special needs "incident to the elimination of racial segregation and discrimination among students and faculty in elementary and secondary schools by contributing to the costs of new or expanded activities ... designed to achieve successful desegregation and the elimination of all forms of discrimination in the schools on the basis of race, color, religion, or national origin." This language, from the Emergency School Assistance Program (ESAP), was included in the larger Emergency School Aid Act, signed into law in June 1972. In this project, Rand staff reanalyzed the data collected in the evaluation of the Emergency School Assistance Program during 1971-72. The reanalysis focused on determining why ESAP had the apparent effect of raising achievement in black male high school students, why a parallel effect for black females did not appear, and the impact of ESAP on school staff attitudes and behavior.

R-1868-HEW, *Secondary Analysis of the Emergency School Assistance Program*, H. Acland, December 1975.

EVALUATION OF TECHNICAL ASSISTANCE AND TRAINING PROGRAMS FUNDED UNDER TITLE IV OF THE CIVIL RIGHTS ACT OF 1964

Office of Education

Term and Scale of Effort: 7/74 - 6/77; 8 person years

Principal Investigators: Stephen Crocker, Nicelma J. King, and Margaret A. Thomas

Title IV of the Civil Rights Act of 1964 authorizes the U.S. Office of Education to provide grants to school districts for technical assistance and training services to meet special needs associated with implementing school desegregation plans. This assistance is provided through direct financial aid to school districts themselves or through financial assistance to various supporting organizations which assist school districts. In the first phase of this research, Rand evaluated Title IV operations under new program regulations

developed in response to an earlier evaluation conducted by the U.S. Commission on Civil Rights. Rand's evaluation examined the types of services and assistance provided and the utility and impact of those services as viewed by program participants at the local level. During fiscal year 1976, the same agencies responsible for delivering technical assistance related to desegregation under Title IV were given the additional responsibility of providing technical assistance and training services to alleviate sex discrimination in education. In the second phase of the research, Rand described and evaluated the activities and organizational procedures of supporting agencies in fulfillment of the new Title IV provisions.

R-1901/1-HEW, *Title IV of the Civil Rights Act of 1964: A Review of Program Operations: Executive Summary*, S. Crocker, R. L. Crain, M. H. Graubard, J. M. Kimbrough, N. J. King, M. A. Thomas, and F. M. Wirt, August 1976.

R-1901/2-HEW, *Title IV of the Civil Rights Act of 1964: A Review of Program Operations*, S. Crocker, R. L. Crain, M. H. Graubard, J. M. Kimbrough, N. King, M. A. Thomas, F. M. Wirt, and L. P. Oliver, August 1976.

R-2136-HEW, *Title IV of the Civil Rights Act of 1964: Expansion of Program Responsibilities*, N. J. King, M. A. Thomas, M. H. Graubard, and L. P. Oliver, May 1977.

IMPLEMENTING INNOVATIONS IN THE PUBLIC SCHOOLS

National Institute of Education

Term and Scale of Effort: 6/74 - 12/77; 2.2 person years

Principal Investigators: Milbrey W. McLaughlin and John Pincus

The public schools are extremely stable in resisting systematic change; neither the economic incentives nor the technological innovations that prompt change in private markets operate to any great extent in education. But federally funded programs in education do not always take into account education's institutional stability. In this study, Rand is investigating the experience of several school districts that have been successful in introducing innovation to determine what kinds of incentives and organizational factors work in supporting educational change.

R-2010-NIE, *An Exploratory Study of School District Adaptation*, P. Berman and M. W. McLaughlin, May 1979.

CHANGE AGENTS IN ELEMENTARY AND SECONDARY EDUCATION

Office of Education

Term and Scale of Effort: 6/73 - 5/77; 17 person years

Principal Investigators: Paul Berman and John Pincus

The Office of Education became increasingly concerned in the 1970s with the problem of determining what innovative practices are most effective and, once they are determined, introducing innovative practices into the nation's school system. Rand examined the strengths and weaknesses of four current programs designed to serve as agents of change in education: Elementary and Secondary Education Act Title III, Bilingual Education (ESEA Title VII), Vocational Education (Part D), and Right-to-Read. ESEA Title III is the broadest in that it funds a variety of academic and enriching programs. Rand studied 150 Title III projects in the second and third year of federal funding and 175 projects in the other five areas of interest, for a total of 325 projects under way in 18 states. The analysis points up those elements of program success within the Office of Education's control (length of project and level of funding, for example) and those that cannot be directly controlled (a project director's personal characteristics or local politics), and suggests guidelines for making future change-agent programs more effective.

R-1589/1-HEW, *Federal Programs Supporting Educational Change, Vol. I: A Model of Educational Change*, P. Berman and M. W. McLaughlin, September 1974.

R-1589/2-HEW, *Federal Programs Supporting Educational Change, Vol. II: Factors Affecting Change Agent Projects*, P. Berman and E. Pauly, April 1975.

R-1589/3-HEW, *Federal Programs Supporting ing Educational Change, Vol. III: The Process of Change*, P. W. Greenwood, D. Mann, and M. W. McLaughlin, April 1975.

R-1589/3-HEW (App. A), *Federal Programs Supporting Educational Change, Vol. III: The Process of Change. Appendix A, Innovations in Classroom Organization and Staff Development*, D. Mann, M. W. McLaughlin, M. Baer, P. W. Greenwood, L. McCluskey, L. L. Prusoff, J. G. Wirt, and G. L. Zellman, April 1975.

R-1589/3-HEW (App. B), *Federal Programs Supporting Educational Change, Vol. III: The Process of Change. Appendix B, Innovations in Reading*, J. G. Wirt, T. I. Endo, L. McCluskey, and J. T. Murphy. April 1975.

R-1589/3-HEW (App. C), *Federal Programs Supporting Educational Change, Vol. III: The Process of Change. Appendix C, Innovations in Bilingual Education*, G. C. Sumner, T. I. Endo, P. W. Greenwood, B. J. Hawkins, L. McCluskey, M. Samulon, and G. L. Zellman, April 1975.

R-1589/3-HEW (App. D), *Federal Programs Supporting Educational Change, Vol. III: The Process of Change. Appendix D, Innovations in Career Education*, A. H. Pascal, R. F. Elmore, T. I. Endo, and L. McCluskey, April 1975.

R-1589/4-HEW, *Federal Programs Supporting Educational Change, Vol. IV: The Findings in Review*, P. Berman and M. W. McLaughlin, April 1975.

R-1589/4-HEW (Abr.), *Federal Programs Supporting Educational Change, Vol. IV (Abridged): A Summary of the Findings in Review*, P. Berman, P. W. Greenwood, M. W. McLaughlin, and J. Pincus, April 1975.

R-1589/5-HEW, *Federal Programs Supporting Educational Change, Vol. V: Executive Summary*, P. Berman, P. W. Greenwood, M. W. McLaughlin, and J. Pincus. April 1975.

R-1589/6-HEW, *Federal Programs Supporting Educational Change, Vol. VI: Implementing and Sustaining Title VII, Bilingual Projects*, G. Sumner and G. L. Zellman, January 1977.

R-1589/7-HEW, *Federal Programs Supporting Educational Change: Factors Affecting Implementation and Continuation*, P. Berman and M. W. McLaughlin, April 1977.

R-1589/8-HEW, *Federal Programs Supporting Educational Change, Vol. VIII: Implementing and Sustaining Innovations*, P. Berman and M. W. McLaughlin, May 1978.

DESIGN OF A NATIONAL LONGITUDINAL STUDY OF THE IMPACT OF SCHOOL DESEGREGATION

U.S. Commission on Civil Rights

Term and Scale of Effort: 6/73 – 9/74; 2.3 person years

Principal Investigator: John Pincus

Rand designed a nationwide, large-scale study of the impact of school desegregation on the individual classroom, school, and community levels. The study considered the administrative process of desegregation, various measures of students' academic achievement, behavioral and attitudinal consequences of desegregation, and parents and community as both mediators and objects of change.

R-1516-USCCR, *Design for a National Longitudinal Study of School Desegregation: Executive Summary*, R. L. Crain, September 1974.

R-1516/1-USCCR, *Design for a National Longitudinal Study of School Desegregation: Volume I, Issues in Theory and Method*, R. L. Crain, D. J. Armor, F. Christen, N. J. King, M. W. McLaughlin, G. C. Sumner, M. A. Thomas, and J. J. Vanecko. September 1974.

R-1516/2-USCCR, *Design for a National Longitudinal Study of School Desegregation: Volume II, Research Design and Procedures*, R. L. Crain, D. J. Armor, F. Christen, N. J. King, M. W. McLaughlin, G. C. Sumner, M. A. Thomas, and J. J. Vanecko. September 1974.

ORGANIZATION AND INCENTIVES IN AMERICAN EDUCATION (formerly ELEMENTARY EDUCATION VOUCHER DEMONSTRATION)

National Institute of Education

Term and Scale of Effort: 4/72 - 3/81; 50 person years

Principal Investigator: Daniel M. Weiler

Under the successive sponsorship of the Office of Economic Opportunity and the National Institute of Education, Rand studied educational vouchers and other systems offering parental choice in education. The voucher demonstration was originally designed as a large-scale social innovation aiming primarily to improve education and to give parents a sense of control over, and satisfaction with, their children's schooling. The voucher mechanism was developed to meet these ends by encouraging the creation of new schools and extending the range of choices open to parents, thereby increasing school staffs' incentives to be more responsive to children's needs.

In practice, this aim turned out to be unrealistic in light of the present structure and incentives of American public schools. Only one school district in the country—Alum Rock, California—was willing to participate in the experiment. It soon became apparent that the district would be unlikely to allow private schools to compete with public schools, or public schools to compete without restriction among themselves. Nonetheless, Alum Rock schools continued to offer a variety of options consisting of differentiated programs within and between schools.

The project staff came to view the voucher demonstration as simply one of a larger class of alternative education programs that school districts are beginning to offer, and expanded the study beyond Alum Rock to cover such districts as Eugene, Oregon, Minneapolis, Minnesota, and Cincinnati, Ohio, where other forms of student and parent choice systems are being tried. The study changed from an exclusive focus on vouchers in Alum Rock to an analysis of the implementation of alternatives in education, with Alum Rock as the primary analysis site.

The study defined concepts of change, improvement, and innovation in education. Following a literature review on incentives, organizations, and school district behavior, Rand offered several propositions about the relationship of district organizational patterns and administrative behavior to the incentives of teachers and administrators to adopt innovations. It analyzed the results of the Alum Rock demonstration and discussed implications of the study conclusions for public policies aimed at promoting improvement and reform in education. Alternative organizational and structural arrangements

for public education were discussed, and related public policies that could be tested in the field were identified.

R-1217-NIE, *Achievement Scores and Educational Objectives*, R. E. Klitgaard, January 1974.

R-1495-NIE, *A Public School Voucher Demonstration: The First Year at Alum Rock*, D. M. Weiler, June 1974.

R-1495/1-NIE, *A Public School Voucher Demonstration: The First Year at Alum Rock, Summary and Conclusions*, D. M. Weiler, June 1974.

R-1495/2-NIE, *A Public School Voucher Demonstration: The First Year at Alum Rock, Technical Appendix*, D. M. Weiler, June 1974.

R-1495/3-NIE, *A Public School Voucher Demonstration: The First Year at Alum Rock, Documentary Appendix*, D. M. Weiler, June 1974.

R-2170/1-NIE, *A Study of Alternatives in American Education, Vol. I: District Policies and the Implementation of Change*, G. V. Bass, April 1978.

R-2170/2-NIE, *A Study of Alternatives in American Education, Vol. II: The Role of the Principal*, M. A. Thomas, April 1978.

R-2170/3-NIE, *A Study of Alternatives in American Education: Teachers' Responses to Alternatives*, R. Rasmussen, March 1981.

R-2170/4-NIE, *A Study of Alternatives in American Education: Vol. IV, Family Choice in Schooling*, R. G. Bridge and J. Blackman, April 1978.

R-2170/5-NIE, *A Study of Alternatives in American Education: Diversity in the Classroom*, P. Barker, T. K. Bikson, and J. M. Kimbrough, February 1981.

R-2170/6-NIE, *A Study of Alternatives in American Education: Student Outcomes in Alum Rock, 1974-1978*, F. J. Capell, March 1981.

R-2170/7-NIE, *A Study of Alternatives in American Education: Summary and Policy Implications*, D. M. Weiler, March 1981.

P-4990, *The Appraisal of Educational Alternatives—Making Evaluation Work in Choosing Future Courses of Action*, S. A. Haggart and M. L. Rapp, April 1973.

P-5631, *The Alum Rock Voucher Demonstration: Three Years of Implementation*, E. Levinson, April 1976.

P-5678, *The Generalizability of the Results of a Standardized Achievement Test*, P. Barker and S. Pelavin, June 1976.

P-5689, *Issues of Reliability of Direcional Bias in Standardized Achievement Tests: The Case of MAT70*, P. Barker and S. Pelavin, July 1976.

P-5680, *The Impact of Multiple Educational Options on Students' Self and Social Perceptions*, T. K. Bikson, April 1977.

P-6141, *The Free Market Approach to Educational Reform*, L. Billet, July 1978.

POSTSECONDARY EDUCATION

AN EVALUATION OF THE LANGUAGE AND AREA STUDIES PROGRAM

Department of Education

Term and Scale of Effort: 10/79 - 12/81; 7.1 person years

Principal Investigator: Lorraine M. McDonnell

Since its inception in 1958, the National Defense Education Act (NDEA) Title VI program has formed the keystone of federal support for international education. Despite its modest funding level, Title VI has profoundly shaped international education in this country and has served as a focus for various competing interests and expectations. Consequently, Title VI now funds activities that range from advanced Ph.D. training to elementary school social studies, and serves not only all educational levels and types of institutions but also some business and community interests. Indeed, it has been suggested that Title VI's scarce resources are spread too thin. This suggestion comes as new groups make claims on the program, the demand for advanced area specialists shifts, and recent foreign policy crises generate renewed interest in foreign language and area studies.

This evaluation of Title VI has six objectives: (1) identifying federal program goals and assessing the extent to which they are being met, (2) describing the operations of the international study centers and assesssing their effectiveness in adapting to changed demand conditions, (3) assessing the "seed money" strategy used in funding graduate and undergraduate studies programs, (4) examining the status and adequacy of foreign language training in those colleges and universities with NDEA Title VI funds, (5) describing supply and demand trends for Ph.D.s in foreign language and area studies, and (6) analyzing the match between the training of center graduates and their subsequent employment.

FOREIGN LANGUAGE AND INTERNATIONAL STUDIES SPECIALISTS: THE MARKETPLACE AND NATIONAL POLICY

National Endowment for the Humanities

Term and Scale of Effort: 2/79 - 8/79; 1 person year

Principal Investigator: John Pincus

The President's Commission on Foreign Languages and International Studies must assess U.S. needs for foreign language and area specialists, ways in which foreign language and international studies contribute to meeting these needs, and the job market for individuals with these skills. Rand staff examined conceptual issues, such as how to treat the supply and demand for

language and area specialists when the constituent fields of specialization are very segmented. The study distinguishes between market demand and supply and concepts of national need which might diverge from market results.

The present and future supply of, as well as demand for, specialists is analyzed, using existing data sources as well as interviews at various institutions by Rand staff. Alternatives for further research are recommended based on the findings of this pilot study.

R-2501-NEH, *Foreign Language and International Studies Specialists: The Marketplace and National Policy*, S. E. Berryman, P. F. Langer, J. Pincus, and R. H. Solomon, September 1979.

POLICY RESEARCH ON SECONDARY EDUCATION IN THE UNITED STATES

The Ford Foundation

Term and Scale of Effort: 6/77 - 10/77; .2 person years

Principal Investigator: P. Michael Timpane

This research was based on a review of a preliminary study, performed by a noted Swedish educator, presenting a comparative analysis of secondary education in industrial nations. Some specific topics under examination were: the implications of declining enrollments and aging faculties, the need for knowledge-processing skills, the impact of changing class composition in high schools, and successful paths to school-based program planning and development.

EXTENSION OF THE COLLEGE-GOING/COLLEGE CHOICE MODEL TO THE NLS CLASS OF 1972 DATA

Department of Health, Education, and Welfare (Assistant Secretary for Planning and Evaluation)

Term and Scale of Effort: 10/76 - 7/77; 1.2 person years

Principal Investigator: Stephen J. Carroll

In recent years, a number of models have been developed to estimate the effect of changes in public policy on college enrollment and attendance patterns. In this project, Rand staff estimated the predictive accuracy of two such models, one developed at Rand and one at the Inner City Fund, by testing them against the data base provided by the National Longitudinal Study of the high school class of 1972. The more accurate model was then used in an analysis of the probable impact of changes in the award rules of the Basic

Educational Opportunity Grant Program on students' college enrollment decisions.

R-2192-HEW/LE, *The Enrollment Effects of Federal Student Aid Policies*, S. J. Carroll, B. Mori, D. A. Relles, and D. Weinschrott, June 1977.

THE EFFECTS OF SECONDARY SCHOOL ON POSTSECONDARY SCHOOL CAREER PATTERNS

Office of Education

Term and Scale of Effort: 8/75 – 12/76; 1 person year

Principal Investigator: Robert L. Crain

Rand staff analyzed the impact of school characteristics on the postsecondary experiences of talented students, particularly talented female and minority youth. The primary concern was with college attendance rates; the secondary concern with incomes of those not in college. The research effort sought to:

- Identify and measure the role of social class, sex and ethnic background in determining students' postsecondary plans.
- Identify problems in secondary school counseling and consider policies available to the federal government to alleviate them.
- Evaluate the effectiveness of existing federal loan programs.
- Contribute knowledge useful in the planning of secondary school desegregation.
- Evaluate the effectiveness of various aid programs for secondary school, including federal aid designed to assist desegregating schools.

The Influence of High School Racial Composition on the College Attendance and Achievement Test Scores of Black Students, R. L. Crain and R. E. Mahard, U.S. Government Printing Office, 1978.

"High School Racial Composition and Black Educational Attainment and Achievement Test Performance," R. L. Crain and R. E. Mahard, *Sociology of Education*, April 1978.

AN ANALYSIS OF ENROLLMENT RATES AND PATTERNS IN INDIANA'S INSTITUTIONS OF HIGHER EDUCATION

Lilly Endowment

Term and Scale of Effort: 7/75 – 1/78; 2 person years

Principal Investigator: Stephen J. Carroll

To plan rationally to meet future demands that will be placed on their higher educational systems, decisionmakers must be able to predict with some

confidence what those demands will be. This research effort identified the factors that influence students' higher educational decisions and estimated their relative importance, in an effort to predict their enrollment choices. The results of the analysis are embodied in a model of the flow of students into the nation's colleges and universities—a model designed to assist higher education decisionmakers in analyzing and anticipating enrollment rates and patterns.

R-2005-NIE/LE, *A Bayesian Model of Choice Among Higher Educational Institutions*, S. J. Carroll and D. A. Relles, July 1976

R-2192-HEW/LE, *The Enrollment Effects of Alternative Federal Student Financial Aid Policies*, S. J. Carroll, B. Mori, D. A. Relles, and D. J. Weinschrott, June 1977.

R-2195-LE, *Demand for Higher Education in the United States: A Critical Review of the Empirical Literature*, D. J. Weinschrott, December 1977.

"Demographic and Economic Influences on the Growth and Decline of Higher Education," S. J. Carroll and P. A. Morrison, in H. Silberman and M. Dinsbrug (eds.), *Easing the Transition from Schooling to Work*, Jossey-Bass, 1976.

P-5693, *A Bayesian Alternative to Conditional Logit Analysis*, S. J. Carroll and D. A. Relles, July 1976.

RESEARCH/ANALYSIS AGENDA FOR THE NATIONAL LONGITUDINAL STUDY OF THE HIGH SCHOOL CLASS OF 1972

Department of Health, Education, and Welfare (Assistant Secretary for Planning and Evaluation)

Term and Scale of Effort: 7/75 - 5/76; 1 person year

Principal Investigator: Stephen J. Carroll

Federal decisionmakers confront a variety of policy issues that hinge on secondary students' decisions whether to continue their education, enter the military, or join the labor force. The National Longitudinal Study, based on a nationwide sample of 22,000 high school students graduating in 1972, was sponsored by the U.S. Office of Education to provide information concerning these decisions and their implications for federal policy. Rand developed a research/analysis agenda for the data base in an effort to foster its efficient use and determine its potential value in deciding policy issues.

R-1964-HEW, *National Longitudinal Study of High School Seniors: An Agenda for Policy Research*, S. J. Carroll and P. A. Morrison, June 1976.

"National Longitudinal Study of High School Seniors: An Agenda for Policy Research," S. J. Carroll and P. A. Morrison, *Review of Public Data Use*, Vol. 5, No. 3, March 1977.

IMPROVING THE EFFICIENCY OF ALTERNATIVE FEDERAL AND STATE HIGHER EDUCATION SUPPORT POLICIES

National Institute of Education

Term and Scale of Effort: 6/74 – 8/76; .8 person years

Principal Investigator: Stephen J. Carroll

In spite of dramatic expansions in the availability of low-cost and geographically accessible higher education, and substantial increases in student assistance funds, low and moderate income students enroll in and complete college education at a rate considerably below that of students from higher income groups. There are numerous legislatively authorized and proposed programs for reducing these income-related differences, but no guidelines for choosing which ones would be most cost-effective. This study tested the validity of behavioral models of students' college-going decisions that could be used to evaluate policy options.

R-2005-NIE/LE, *A Bayesian Model of Choice among Higher Education Institutions*, S. J. Carroll and D. A. Relles, June 1976. •

A PILOT STUDY FOR THE DEVELOPMENT AND IMPLEMENTATION OF BEHAVIORAL MODELS IN HIGHER EDUCATION POLICY ANALYSIS

National Science Foundation

Term and Scale of Effort: 5/73 – 9/75; 2.6 person years

Principal Investigator: Stephen J. Carroll

The nation has entered a period of much slower growth in higher education enrollment rates, and states are now concerned with refining their higher education systems. Equity of opportunity is one of the newly important issues. A basic problem confronting state decisionmakers is how to direct program and campus development and financial aid and admission policies in conjunction with federal policies and programs in order to expand equitable access to the higher education system. Rand developed behavioral models of student decisionmaking that could be used to estimate the effect of alternative policies on college-going rates.

R-1470-NSF, *An Empirical Investigation of Factors Which Influence College-Going Behavior*, M. G. Kohn, C. F. Manski, and D. S. Mundel, September 1974.

R-1735-NSF, *The Transition from High School to College: A Study of Freshman Enrollments in Florida*, S. J. Carroll and D. A. Relles, August 1975.

EDUCATIONAL RESEARCH AND DEVELOPMENT

EDUCATION, DELINQUENCY PREVENTION, AND THE SEARCH FOR YOUTH POLICY: AN HISTORICAL INQUIRY

National Institute of Education

Term and Scale of Effort: 9/80 - 9/82; 3 person years

Principal Investigator: Steven Schlossman

Despite the prominence of "delinquency prevention" in education and juvenile justice literature, very little is known about its historical development. It is often assumed that the very notion of delinquency prevention, in either theory or practice, is of recent origin. This mistaken assumption frequently leads to oversimplification, gives little indication of the range or extent of program experimentation, and provides an inadequate framework for assessing change and continuity in delinquency prevention policies and programs.

Staff are conducting an historically grounded inquiry into the theory and practice of delinquency prevention in current-day America, focusing on reformist, "progressive" efforts in delinquency prevention in the past so as to better comprehend similar efforts in the present. Combining two different styles of inquiry—archival research and fieldwork—the analysts, examining the same policy theme in different time periods, will incorporate a systematic dialogue between the past and present into their policy research.

THE CURRICULUM STUDIES OF THE 1960s: IMPLICATIONS FOR FEDERAL RESEARCH AND DEVELOPMENT POLICY

National Institute of Education

Term and Scale of Effort: 10/74 - 1/79; 2.5 person years

Principal Investigators: John G. Wirt and John Pincus

The federally supported research and development projects that made up the curriculum development movement of the 1960s represented the first time the federal government had actively intervened in the character of American education. More than $200 million was spent in support of some 30 curriculum studies, mostly in science and mathematics, but also in languages and social studies. In this study Rand systematically assessed the impact of these curriculum projects and investigated their implications for federal educational R&D policy.

AN AGENDA FOR EDUCATIONAL RESEARCH AND DEVELOPMENT

The Carnegie Corporation

Term and Scale of Effort: 7/71 - 12/74; 3.2 person years

Principal Investigator: Roger E. Levien

Annual investments in R&D in the health and agriculture sectors, each of which contributes about as much as the education sector to the gross national product, total considerably more than similar investments in education. Federal investments in research and development between 1950 and 1970 came to $14 billion for health, $7 billion for agriculture, and less than $1 billion for education. This project sought to describe an enlarged national research and development program in education and indicate its potential use in improving the nation's educational system.

R-663-RC/CC, *Alternatives in California School Finance*, S. M. Barro, May 1971.

R-1210-CC/RC, *A Statistical Search for Unusually Effective Schools*, R. E. Klitgaard and G. R. Hall, March 1973.

CAREER EDUCATION

Office of Education

Term and Scale of Effort: 6/71 - 2/73; 1.2 person years

Principal Investigators: Roger E. Levien and John Pincus

Rand prepared a planning document for the Office of Education to distribute to contractors submitting bids on the development of home-based career education programs. Rand used as examples such successful media-based educational programs as "Sesame Street," the Chicago Junior College's adult education program, and "Sunrise Semester."

R-1089-USOE/MF, *Three Models for Television*, R. Bretz, October 1972.

R-1199-HEW, *Career Education: An R&D Plan*, S. A. Raizen, S. J. Carroll, A. Lieberman, J. N. Williamson, and J. G. Wirt, May 1973.

HUMAN RESOURCES PROJECTS

THE DYNAMICS OF WELFARE DEPENDENCY

The Ford Foundation

Term and Scale of Effort: 8/76 - 2/77; .2 person years

Principal Investigator: David W. Lyon

Drawing on past studies and data, Rand produced a paper describing the characteristics of families that turn to welfare, their long-term patterns of dependency, and the extent to which public employment programs affect the frequency and duration of dependency. This paper was one of a series of papers sponsored by The Ford Foundation to provide an historical perspective on various facets of welfare and employment policy.

"The Dynamics of Welfare Dependency," D. W. Lyon, in L. M. Salamon (ed.), *Welfare: The Elusive Consensus*, Praeger, 1978.

P-5769, *The Dynamics of Welfare Dependency: A Survey*, D. W. Lyon, December 1976.

PARTICIPATION IN THE AID TO FAMILIES WITH DEPENDENT CHILDREN-UNEMPLOYED FATHERS PROGRAM

Health Care Financing Administration

Term and Scale of Effort: 7/76 - 4/78; 5.6 person years

Principal Investigator: David W. Lyon

The AFDC-Unemployed Fathers program is the only federally supported income maintenance program designed to aid needy families with dependent children where deprivation is due to unemployment of the father rather than desertion, death, or incapacity. From the program's inception, participation has been less than expected. The low participation rate has been explained by various hypotheses centering on the features of voluntary state participation, tight eligibility criteria, and relatively rapid caseload turnover. In this project, Rand staff identified and measured the impact of various factors determining individual decisions to participate in the program, including program features, administrative policies, and attitudes toward welfare. The results of the research indicated the extent to which changes in programs, policies, and external factors will affect AFDC-UF caseloads. Mandatory state participation in the AFDC-UF program and treatment of unemployment insurance as an income source for AFDC-UF cases are two policy changes that were assessed.

R-2316-HEW, *Family Participation in AFDC-Unemployed Fathers*, J. R. Hosek, August 1978.

R-2471-HEW, *The AFDC-Unemployed Fathers Program and Welfare Reform*, J. R. Hosek, August 1979.

N-1008-HEW, *AFDC-Unemployed Fathers Cross-State Data Base, 1975: Definition of Variables, Listing of Data, and Documentation of Sources*, J. Antel, R. Buddin, and J. R. Hosek, May 1979.

N-1283-HEW, *The AFDC-Unemployed Fathers Program: An Effective Basis for Welfare Reform?*, J. R. Hosek, August 1979.

P-6254, *Welfare Research and Experimentation: Testimony before the Subcommittee on Public Assistance of the Senate Finance Committee*, J. F. Cogan, D. W. Lyon, and F. R. Welch, June 1979.

P-6361, *An Introduction to Estimation with Choice-Based Sample Data*, J. R. Hosek, July 1979.

DECISIONMAKING PROCESSES AMONG ELDERLY CONSUMERS

National Science Foundation

Term and Scale of Effort: 6/76 – 10/78; 3.3 person years

Principal Investigator: Tora K. Bikson

The proliferation of products and of information about products has made it more difficult for consumers to reach decisions. This problem is especially serious among elderly consumers. Health-related constraints associated with age increase the potential risk of poor decisions, and income constraints render each purchase more consequential. This research identified ways in which the decisions of elderly consumers are less than optimal, and determining means of improving the decisionmaking processes of the elderly through product regulation and consumer information programs.

R-2361-NSF, *Consumer Decision Processes Among Older Adults*, T. Bikson and J. Goodchilds, September 1978.

ANALYSIS OF THE RELATIONSHIP BETWEEN AID TO FAMILIES WITH DEPENDENT CHILDREN RECIPIENTS AND THE ECONOMY

State of California (Department of Benefit Payments)

Term and Scale of Effort: 1/76 – 1/77; 1.4 person years

Principal Investigator: David M. de Ferranti

The California Department of Benefit Payments requires for its budget planning an understanding of the interrelationship between general economic conditions and the growth and decline of the welfare caseload. The research under this project emphasized the correlation of changes in unemployment in specific sectors of the labor market with changes in the AFDC caseload.

R-2115-CDOBP, *AFDC Caseload and the Job Market in California: Selected Issues*, A. F. Abrahamse, D. M. de Ferranti, P. D. Fleischauer, and A. J. Lipson, January 1977.

THE INCIDENCE OF MULTIPLE WELFARE BENEFITS IN NEW YORK CITY

Social and Rehabilitation Service

Term and Scale of Effort: 7/75 - 9/76; 2.4 person years

Principal Investigator: David W. Lyon

This project focused on measuring transfer program benefits received by Aid to Families with Dependent Children recipients in New York City. Benefits measured included public assistance, Medicaid (Ambulatory and Inpatient Care), Housing, Food Stamps and Social Services. The unit of analysis was the AFDC welfare case. A major policy question answered was how many families receive a cash value of transfer benefits high enough to raise their incomes over the poverty line and into the income range associated with non-welfare "working poor" families. Benefit measurements were for transfers actually received by each case, rather than hypothetical benefit levels based upon administrative grant schedules.

R-2002-HEW, *Multiple Welfare Benefits in New York City*, D. W. Lyon, P. A. Armstrong, J. R. Hosek, and J. J. McCall, August 1976.

SURVEY AND ANALYSIS OF WELFARE CASELOAD PROJECTION METHODS EMPLOYED BY STATES IN PROJECTING AND SUBSTANTIATING BUDGET EXPENDITURES

State of California (Department of Benefit Payments)

Term and Scale of Effort: 7/75 - 3/76; .5 person years

Principal Investigator: David M. de Ferranti

This project involved a survey and analysis of methods of welfare caseload projection either currently used by states or developed in the relevant literature. The study was designed to assist state and local administrators in their dual concerns of reducing welfare dependency and ensuring the availability of adequate funding.

R-1916-CDOBP, *Welfare Caseload Estimating Techniques: A Survey and Evaluation*, A. F. Abrahamse, D. M. de Ferranti, P. D. Fleischauer, and A. J. Lipson, January 1976.

THE EFFECTIVENESS OF THE AMERICAN EDUCATION SYSTEM IN FACILITATING ADAPTATION TO TECHNOLOGICAL CHANGE

National Science Foundation

Term and Scale of Effort: 7/74 – 5/76; 1.3 person years

Principal Investigator: Duran Bell

Technological change threatens to render many skills in the labor market obsolete. Rand reviewed the available literature on the effectiveness of the American educational system in preparing people for technological change affecting the requirements of their jobs.

R-1821-NSF, *The Role of Education in Facilitating Adaptation to Technological Change: An Analytical Framework and Review of the Literature*, D. Bell, T. K. Bikson, P. J. Rich, and J. M. Wuchitech, June 1976.

ASSESSING THE NEEDS OF LOW-INCOME AND MINORITY ELDERLY PEOPLE

Administration on Aging

Term and Scale of Effort: 7/74 – 9/75; 1.7 person years

Principal Investigator: Duran Bell

The elderly are often thought of as a homogeneous group, and programs designed to aid them may reflect this bias. However, the characteristics of the elderly are as varied as those of younger people. Through a review of the analytical literature on age-group stratifications and peer-group differences among age groups over 60, the study addressed such issues as housing, education, and poverty as they affect older people of varying ethnic and income groups.

R-1862-HEW, *Delivering Services to Elderly Members of Minority Groups: A Critical Review of the Literature*, D. Bell, P. Kasschau, and G. L. Zellman, April 1976.

MENTAL HEALTH AND MENTAL RETARDATION SERVICES IN THE STATE OF NEVADA

The Max C. Fleischmann Foundation

Term and Scale of Effort: 11/73 – 1/76; 3.3 person years

Principal Investigators: Garry D. Brewer and James S. Kakalik

All major types of services needed by mentally handicapped persons in Nevada were considered in this comprehensive planning study. Information was provided to the Fleischmann Foundation, and subsequently to state officials and the public, on current services, problems, and means of improving

the quality and quantity of services to persons of all ages who have a mental health disorder or are mentally retarded. The study was conducted in conjunction with the Nevada Legislature and various service agencies.

R-1800-FLF, *Mental Health and Mental Retardation Services in Nevada*, J. S. Kakalik, G. D. Brewer, L. L. Prusoff, D. J. Armor, and P. A. Morrison, April 1976.

R-1800/1-FLF, *Mental Health and Mental Retardation Services in Nevada: Executive Summary*, J. S. Kakalik, G. D. Brewer, L. L. Prusoff, D. J. Armor, and P. A. Morrison, April 1976.

DESIGNING AN EVALUATION OF SOCIAL COMPETENCY IN HEAD START CHILDREN

Department of Health, Education, and Welfare (Office of Child Development)

Term and Scale of Effort: 7/73 – 11/74; 4.6 person years

Principal Investigators: Sue E. Berryman and Senta A. Raizen

The overall goal of the Head Start program is "to bring about a greater degree of social competence in disadvantaged children." The phrase "social competence" is intended to encompass all the significant outcomes of a Head Start experience, including those in the broad areas of cognitive and language development, social and emotional functioning, and physical and mental health. Rand designed a national evaluation of the impact of Head Start on those aspects of social competence in children which it seeks to improve. While previous evaluations of Head Start have been limited to cognitive outcomes, Rand's evaluation design includes outcomes in all major areas of child development: health and nutrition, perceptual-motor/cognitive/language skills, and social and personal development.

R-1556-HEW, *Toward a New Cognitive Effects Battery for Project Head Start*, J. A. Butler, November 1974.

R-1557-HEW, *Design for a National Evaluation of Social Competence in Head Start Children*, S. A. Raizen, S. B. Bobrow, T. K. Bikson, J. A. Butler, K. A. Heald, and J. D. Ratteray, November 1974.

EVALUATION OF POLICY-RELATED RESEARCH ON ALTERNATIVE PUBLIC AND PRIVATE PROGRAMS FOR MID-LIFE REDIRECTION OF CAREERS

National Science Foundation

Term and Scale of Effort: 6/73 – 1/75; 1.8 person years

Principal Investigator: Anthony H. Pascal

Currently some 25 million adults are enrolled in adult education programs, but most of these programs are not geared to provide the concentrated

training that will lead to a new career for a mature individual. While career training for the young will always look more attractive in strict cost-benefit terms, there are growing reasons for providing programs to deal with the frustration, waste, and alienation that dead-end jobs and obsolescent skills represent to many Americans. Rand reviewed and evaluated what is known about mid-life career redirection as a basis for developing new programs in this area.

R-1582/1-NSF, *An Evaluation of Policy Related Research on Programs for Mid-Life Career Redirection: Vol. I—Executive Summary*, A. H. Pascal, February 1975.

R-1582/2-NSF, *An Evaluation of Policy Related Research on Programs for Mid-Life Career Redirection: Vol. II—Major Findings*, A. H. Pascal, D. Bell, L. A. Dougharty, W. L. Dunn, V. M. Thompson, L. S. Olson, and L. L. Prusoff, February 1975.

EVALUATION OF ALTERNATIVE WAYS TO INCREASE CITIZEN PARTICIPATION IN DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE PROGRAMS

Department of Health, Education, and Welfare (Assistant Secretary for Planning and Evaluation)

Term and Scale of Effort: 6/72 - 9/73; 2 person years

Principal Investigators: Roger E. Levien and Peter L. Szanton

The Community Action and Model Cities programs featured citizen participation in the design and operation of federal programs. Such participation may reduce individuals' feelings of powerlessness and alienation from government and improve program effectiveness. In this study, Rand assisted the Department of Health, Education, and Welfare in evaluating the objectives of increased citizen participation in HEW programs and in selecting the means for improving citizen control over program policies.

R-1196-HEW, *Citizen Organizations: Increasing Client Control over Services*, R. K. Yin, W. A. Lucas, P. L. Szanton, and J. A. Spindler, April 1973.

EVALUATION OF PROGRAMS FOR HANDICAPPED YOUTH

Department of Health, Education, and Welfare (Assistant Secretary for Planning and Evaluation)

Term and Scale of Effort: 2/72 - 4/74; 6.7 person years

Principal Investigator: James S. Kakalik

More than 9 million mentally or physically handicapped children in the United States are impaired enough to need services not required by normal youth, and nearly $5 billion is spent annually on services by all levels of

government. Rand assisted the Department of Health, Education, and Welfare in conducting a comprehensive cross-agency evaluation and planning effort of federal and state programs providing services needed by handicapped children.

R-1220-HEW, *Services for Handicapped Youth: A Program Overview*, J. S. Kakalik, G. D. Brewer, L. A. Dougharty, P. D. Fleischauer, and S. M. Genensky, May 1973.

R-1220-HEW (Abridged), *Services for Handicapped Youth: A Program Overview*, J. S. Kakalik, G. D. Brewer, L. A. Dougharty, P. D. Fleischauer, and S. M. Genensky, May 1973.

R-1420-HEW, *Improving Services to Handicapped Children*, J. S. Kakalik, G. D. Brewer, L. A. Dougharty, P. D. Fleischauer, S. M. Genensky, and L. M. Wallen, May 1974.

R-1420/1-HEW, *Improving Services to Handicapped Children: Summary and Recommendations*, G. D. Brewer and J. S. Kakalik, May 1974.

Handicapped Children Strategies for Improving Services, G. D. Brewer and J. S. Kakalik, McGraw Hill, 1979.

SEX EQUITY OF SERVICES AND EFFECT ON SEX DESEGREGATION OF OCCUPATIONS

National Commission for Employment Policy

Term and Scale of Effort: 5/80 - 1/81; .5 person years

Principal Investigator: Sue E. Berryman

Staff prepared a technical background paper for the National Commission on Employment Policy. The paper uses data from a longitudinal survey of Comprehensive Employment and Training Act (CETA) participants, sponsored by the Employment and Training Administration of the U.S. Department of Labor. The analysis estimates male and female participation rates in different CETA programs; assess whether CETA supplies enrollment and specific services equitably by sex; and determine the extent to which CETA prepares female enrollees for non-traditional occupations.

CRITICAL REVIEW OF THREE TASK FORCE AND PANEL REPORTS ON YOUTH AND ADOLESCENT EDUCATION

Department of Health, Education, and Welfare (Assistant Secretary for Planning and Evaluation)

Term and Scale of Effort: 5/75 – 12/75; 1 person year

Principal Investigator: P. Michael Timpane

Three reports on adolescent youth, Youth: Transition to Adulthood, The Reform of Secondary Education, and Report of the National Panel on High School and Adolescent Education, represent a collection of assumptions, evidence, and policy recommendations most commonly accessible to those responsible for federal policy on adolescent education. There is a substantial degree of overlap in the drift of their recommendations: more contact between youth and adults, for example, particularly in work-related settings, and a greater variety of educational paths. However, on close review, the reports can be seen to diverge in fundamental ways in their perception of causes and cures. This research analyzed the three reports and examined their relevant theory and data.

R-2006-HEW, *Youth Policy in Transition*, P. M. Timpane, S. Abramowitz, S. B. Bobrow, and A. H. Pascal, June 1976.

ENERGY POLICY

Walter S. Baer, Program Director

The Energy Policy Program conducts research on domestic and international policy issues related to the production and use of energy. Drawing upon Rand's diverse staff expertise, the research emphasizes the interactions among the technical, economic, social, and institutional components of energy policymaking.

Sponsors of research have been the U.S. Department of Energy (DOE) and other federal agencies, the California Legislature and state agencies, the Los Angeles Department of Water and Power, the Electric Power Research Institute, and private foundations. The Department of Energy supports a broad program of national energy policy studies including oil import dependence and related international issues; pricing and regulation of energy markets; research, development, demonstration, and commercialization strategies; and management of the nuclear fuel cycle. The DOE also supports two multi-year research programs on energy demand and conservation, and nonrenewable energy resources and technologies. Additional research in the program focuses on electricity demand, supply and pricing; nuclear fuel cycle issues; and other energy topics.

From 1973 to 1978, the Energy Policy Program was directed by Fred S. Hoffman. Walter S. Baer became Program Director in 1978.

NATIONAL ENERGY POLICY STUDIES

ENERGY POLICY AND PLANNING ISSUES

Department of Energy

Term and Scale of Effort: 4/76 - 4/81; 92.0 person years

Principal Investigator: Walter S. Baer

Since 1976, Rand has conducted an integrated program of policy research and analysis for the Department of Energy (DOE) and its predecessor, the Energy Research and Development Administration. Research has covered a wide range of energy policy issues, including:

International Energy Issues

- World oil market trends.
- Management of international energy crises.
- Western Hemisphere oil production.
- U.S.-Mexico energy relations.
- Energy supplies and R&D in the Soviet Union.
- Oil and energy use in developing countries.

Energy Pricing, Regulation, and Conservation

- Benefits and costs of electricity rate structure changes.
- Effects of price regulation on gasoline supplies.
- Effects of natural gas price regulation on alternative energy sources.
- Impact of state severance taxes on coal prices and consumption.
- Federal-state-local relationships in environmental regulation.
- Regulatory issues in synthetic fuel development.
- Planning for energy conservation demonstrations in the residential sector.

Research, Development, Demonstration (RD&D), and Commercialization Strategies

- Cost, performance, schedule and risk tradeoffs in energy RD&D programs.
- Improving capital cost estimation methods.
- Industrial experience in estimating cost of innovative process plants.
- Commercialization of oil shale, coal gasification and other synthetic fuels.
- DOE policy and program planning.
- Evaluation of ocean thermal energy conversion (OTEC) technologies.

Management of the Nuclear Fuel Cycle

- Nuclear power and weapons proliferation.
- Management of nuclear spent fuels.
- Methodologies to assess risk from nuclear and other energy technologies.

R-2179-DOE, *Projected Nationwide Energy and Capacity Savings from Peakload Pricing of Electricity in the Industrial Sector*, J. P. Acton, W. G. Manning, and B. M. Mitchell, June 1978.

R-2239-DOE, *Nuclear Reactor Spent Fuel Valuation—Procedure, Application and Analysis*, K. A. Solomon, February 1978.

R-2253-DOE, *Soviet Energy R&D: Goals and Rationale, Plans, and R&D Performers*, R. Campbell, May 1978.

R-2257-DOE, *Soviet Energy Balances*, R. Campbell, December 1978.

R-2267-DOE, *An Examination of Alternative Nuclear Breeding Methods*, B. W. Augenstein, D. Dreyfuss, W. E. Mooz, and P. Sher, July 1978.

R-2274-DOE, *Balancing Energy and the Environment: The Case of Geothermal Development*, P. L. Ellickson, S. Brewer, and K. Knight, June 1978.

R-2282-DOE, *Average Cost Pricing of Natural Gas: A Problem and Three Policy Alternatives*, F. A. Camm, July 1978.

R-2293-DOE, *Constraints on the Commercialization of Oil Shale*, E. W. Merrow, July 1978.

R-2294-DOE, *Prospects for the Commercialization of High-BTU Gasification*, W. F. Hederman, April 1978.

R-2304-DOE, *Cost Analysis of Light Water Reactor Power Plants*, W. E. Mooz, June 1978.

R-2327-DOE, *Ericsson Cycle Gas Turbine Powerplants*, W. H. Krase, March 1979.

R-2335-DOE, *Resolving Environmental Issues in Energy Development: Roles for the Department of Energy and Its Field Offices*, P. L. Ellickson and E. W. Merrow, January 1979.

R-2481-DOE, *A Review of Cost Estimation in New Technologies: Implications for Energy Process Plants*, E. W. Merrow, S. W. Chapel, and J. C. Worthing, July 1979.

R-2488-DOE, *Demand for Oil and Energy in Developing Countries*, J. L. Navarro, C. Wolf, Jr., and D. A. Relles, May 1980.

R-2508-DOE/DWP, *British Industrial Response to the Peak-Load Pricing of Electricity*, J. P. Acton, E. H. Gelbard, J. R. Hosek, and D. J. McKay, February 1980.

R-2510-DOE, *Mexico's Petroleum and U.S. Energy: Implications for the 1980's*, D. F. Ronfeldt, R. D. Nehring, and A. Gándara, June 1980.

R-2510/1-DOE, *Mexico's Petroleum and U.S. Energy: Implications for the 1980s: Executive Summary* D. F. Ronfeldt and R. D. Nehring, June 1980.

R-2515-DOE, *Household Energy Use in Non-OPEC Developing Countries*, J. Fernandez, May 1980.

R-2537-DOE, *Policy and Program Planning in the Department of Energy*, T. K. Glennan Jr., and D. Seidman, February 1980.

R-2558-DOE, *Away-From-Reactor Storage and Disposal of Spent Nuclear Fuel: Factors Affecting Demand*, P. M. Dinneen, K. A. Solomon, and M. B. Triplett, forthcoming.

R-2561-DOE, *Issues and Problems in Inferring a Level of Acceptable Risk*, S. A. Salem, K. A. Solomon, and M. S. Yesley, July 1980.

R-2573-DOE, *World Oil Market Trends and U.S. Energy Policy*, F. S. Hoffman and M. P. Kennedy, forthcoming.

R-2595-DOE, *Quantitative Evaluation of Closed Cycle Ocean Thermal Energy Conversion*, E. C. Gritton and J. Aroesty, May 1980.

R-2641-DOE, *Quantitative Evaluation of Ocean Thermal Energy Conversion (OTEC): Executive Briefing*, E. C. Gritton, R. Y. Pei, and R. W. Hess, November 1980.

N-1006-DOE, *Evaluating Fuel Economy Taxes: An Exploratory Cost-Benefit Analysis*, J. P. Stucker, October 1979.

N-1150-DOE, *The Economic Competitiveness of Methanol as a Motor Fuel*, S. H. Dole, May 1979.

N-1169-1-DOE, *The Role of Department of Energy Field Offices in the Commercialization of Energy Technologies*, T. K. Glennan, Jr., W. S. Baer, and P. L. Ellickson, June 1979.

N-1176-DOE, *Valuation of Nuclear Reactor Spent Fuel Using the HP 67/97 Programmable Calculator*, K. A. Solomon and M. B. Triplett, April 1979.

N-1204-DOE, *Models, Complexity, and Error*, D. Leinweber, June 1979.

N-1245-DOE, *Potential Organizational Problems of the Proposed Alaska Natural Gas Pipeline Project*, R. E. Horvath, January 1980.

N-1332-DOE, *Basic Data on Soviet Energy Branches*, R. Campbell, December 1979.

N-1435-DOE, *Evolution of the Regulation of High Cost Gas Supplies*, W. F. Hederman, February 1980.

N-1469-DOE, *Values and Conflict: Design Considerations for a Two-Stage Synfuels Development Strategy*, D. Seidman, April 1980.

N-1517-DOE, *Resource Estimate for Ocean Thermal Energy Conversion (OTEC) in the Gulf of Mexico*, R. Y. Pei, September 1980.

"Demographic Trends Impinging on Energy Use," P. A. Morrison, in C. T. Unseld et al., *Sociopolitical Effect of Energy Use and Policy*, National Academy of Sciences, Washington, D.C., 1979.

P-5862, *Worldwide Energy Demand and Supply: Medium-Term Forecasts*, H. Mendershausen, May 1977.

P-5912, *Energy Choices and Preference Relation Paradoxes*, B. W. Augenstein, July 1977.

P-6006, *Real-Time Individual Rationing as a Response to an Electricity Shortage*, D. J. McKay, September 1977.

P-6017, *Reliability of Service and Optimal Pricing of Electricity*, D. J. McKay, October 1977.

P-6047, *Fusion-Fission Hybrid Breeders—Economic and Performance Issues, Role of Advanced Converters, Interdependence between Fission and Fusion Programs*, B. W. Augenstein, December 1977.

P-6127, *The Effects of Fuel Economy Mandates and Taxes on Drivers: Impacts by Income Group*, J. P. Stucker, August 1978.

P-6175, *Economic Regulation of LNG Imports*, W. F. Hederman, August 1978.

P-6240, *A Procedure for Nuclear Reactor Spent Fuel Valuation*, K. A. Solomon and M. B. Triplett, November 1978.

P-6280, *The ASEAN Energy Scene in Global Perspective*, G. J. Pauker, December 1978.

P-6303, *Methanol as an Automobile Fuel*, S. H. Dole, February 1979.

P-6368, *Eastern Europe and Oil: The Soviet Dilemma*, E. S. Burger, October 1979.

P-6372, *When Can Cost-Reducing R&D Be Justified—A Simple Explanatory Model*, B. W. Augenstein, September 1979.

P-6422, *Gathering Information on Costs of Service: Some Basic Considerations for Implementation of PURPA*, J. P. Acton, F. A. Camm, and D. J. McKay, October 1979.

P-6448, *Real Time Pricing and Deregulating the Electricity Market*, D. Leinweber, February 1980.

P-6526, *Oil and Energy Demand in Developed Countries in 1980*, C. Wolf, Jr., D. A. Relles, and J. Navarro, June 1980.

P-6550, *U.S. Responses to Oil Supply Vulnerability*, W. S. Baer, July 1980.

POTENTIAL SOLUTIONS TO THE NATION'S ENERGY PROBLEMS: NONRENEWABLE RESOURCES AND TECHNOLOGIES

Department of Energy

Term and Scale of Effort: 10/80 – 10/83; 24 person years

Principal Investigator: Edward W. Merrow

This study builds on Rand's prior energy studies in the areas of cost estimation, technical systems analysis, and resource evaluation to investigate the increased production of energy from "nonrenewable" resources, such as coal, synthetic fuels, and nuclear power. The principal aim of the project is to assess the government's role in developing nonrenewable energy resources and to lay out alternative strategies that can be pursued. Individual studies supported under the contract will reinforce and complement each other to produce an integrated and coherent analysis of development issues and strategies.

The major focus of the first year of work will be a thorough examination of the problems and opportunities associated with oil shale development. Oil shale, second only to coal among the nation's fossil energy resources, can potentially provide a significant portion of liquid fuel needs. Staff will examine oil shale technologies, cost and systems performance, resource evaluation, and institutional and environmental problems.

POTENTIAL SOLUTIONS TO THE NATION'S ENERGY PROBLEMS: ENERGY CONSUMPTION AND CONSERVATION

Department of Energy

Term and Scale of Effort: 10/80 – 10/83; 17 person years

Principal Investigator: Leland L. Johnson

This study examines and assesses conservation measures at the federal, state, and local levels to reduce energy consumption. Initial work is focusing on three topics:

- Evaluation of the ways in which energy prices, consumer income, demographic characteristics, social-psychological factors, and market imperfections interact to affect consumer behavior, which, in turn, shapes the demand for energy.
- Examination of the ways in which conservation programs can best be targeted, given the nature of such consumer responses, and in the light of efficiency and distributional objectives.
- Evaluation of the effects on energy savings, efficiency, and distributional outcomes of combining various sets of conservation programs.

Staff are reexamining previous research to evaluate consumer responses to a wide range of new conservation measures, to improve on earlier esti-

mates, and to define more closely the places where government intervention is and is not justified.

THE GROWING DEMAND FOR ENERGY

National Science Foundation

Term and Scale of Effort: 7/70 - 7/77; 42 person years

Principal Investigator: Deane N. Morris

Beginning in 1970, more than three years before the 1973 Arab oil embargo brought energy policy to national attention, Rand analyzed future energy demand, measures proposed to conserve energy, and policies designed to induce adoption of those measures. This comprehensive study embraced the four basic sectors of the economy: residential, commercial, industrial, and transportation. A portion of Rand's earlier research was concerned with developing methodologies for projecting electricity use in California. Measures designed to reduce electrical energy demand were analyzed, implications of these actions examined, and potential effects of a reduction in electricity consumption on economic growth assessed. Later research focused on an analysis of selected policies affecting the transportation sector, which consumes by far the greatest proportion of petroleum products of any single sector, and in particular on the private automobile, which accounts for more than half of the petroleum products used in this sector. Rand also examined the possibility of developing synthetic fuels from coal, oil shale and cellulose materials.

R-719-NSF, *Toward Econometric Estimation of Industrial Energy Demand: An Experimental Application to the Primary Metals Industry*, K. P. Anderson, December 1971.

R-756-NSF, *Signed Digraphs and the Growing Demand for Energy*, F. S. Roberts, May 1971.

R-804-NSF, *The Effect of Fuel Price Increases on Energy Intensiveness of Freight Transport*, W. E. Mooz, December 1971.

R-905-NSF, *Residential Demand for Electricity: Econometric Estimates for California and the United States*, K. P. Anderson, January 1972.

R-926-NSF, *Pulse Processes on Signed Digraphs: A Tool for Analyzing Energy Demand*, T. A. Brown, F. S. Roberts, and J. H. Spencer, March 1972.

R-927/1-NSF, *Building an Energy Demand Signed Digraph I: Choosing the Nodes*, F. S. Roberts, April 1972.

R-927/2-NSF, *Building an Energy Demand Signed Digraph II: Choosing Edges and Signs and Calculating Stability*, F. S. Roberts, May 1972.

R-988-NSF, *Methods for Estimating the Volume and Energy Demand of Freight Transport*, D. P. Tihansky, December 1972.

R-993-NSF, *A Probabilistic Forecasting Methodology Applied to Electric Energy Consumption*, R. G. Salter, June 1973.

R-1098-NSF, *Future Energy Demand and Its Effect on the Environment*, D. N. Morris, September 1972.

R-1297-NSF, *Residential Energy Use: An Econometric Analysis*, K. P. Anderson, October 1973.

R-1360-NSF, *The Potential for Energy Conservation in Commercial Air Transport*, J. J. Mutch, October 1973.

R-1391-NSF, *Transportation Energy Use in the United States: A Statistical History, 1955-1971*, J. J. Mutch, December 1973.

R-1498-NSF, *Residential Water Heating: Fuel Conservation, Economics, and Public Policy*, J. J. Mutch, May 1974.

R-1561-NSF/FEA, *Econometric Models of the Demand for Motor Fuel*, B. K. Burright and J. H. Enns, April 1975.

R-1562-NSF, *A Generalized Model for Comparing Automobile Design Approaches to Improved Fuel Economy*, T. F. Kirkwood and A. D. Lee, January 1975.

R-1578-NSF, *Weighted Digraph Models for Energy Use and Air Pollution in Transportation Systems*, F. S. Roberts, December 1974.

R-1590-NSF, *The Long-Run Marginal Costs of Energy*, K. P. Anderson and J. C. De Haven, February 1975.

R-1591-NSF/EPA, *A Simulation Analysis of U.S. Energy Demand, Supply, and Prices*, K. P. Anderson, October 1975.

R-1623-NSF, *Energy Conservation in Nonresidential Buildings*, R. G. Salter, R. L. Petruschell, and K. A. Wolf, October 1976.

R-1641-NSF, *Energy Use and Conservation in the Residential Sector: A Regional Analysis*, S. H. Dole, June 1975.

R-1842-NSF/FEA, *The Economic Impact of Automobile Travel Cost Increases on Households*, J. P. Stucker and T. F. Kirkwood, July 1977.

N-1005-NSF, *Evaluating Fuel Economy Mandates: An Exploratory Cost-Benefit Analysis*, J. P. Stucker, B. K. Burright, and W. E. Mooz, February 1980.

How to Save Gasoline: Public Policy Alternatives for the Automobile, S. Wildhorn, B. K. Burright, J. H. Enns, and T. F. Kirkwood, Ballinger 1976.

P-5858, *Modeling the Response of the Domestic Automobile Industry to Mandates for Increased Fuel Economy: An Industry Model*, J. P. Stucker, B. K. Burright, and W. E. Mooz, June 1977.

A PRELIMINARY ANALYSIS OF THE EFFECTS OF A GOVERNMENT SUBSIDY FOR EFFICIENT AUTOMOBILES

National Science Foundation

Term and Scale of Effort: 7/75 - 11/75; .6 person years

Principal Investigator: James P. Stucker

A federal policy of subsidizing the purchase of automobiles that offer good gas mileage (efficient cars) could have a variety of effects depending upon the response of automobile purchasers and suppliers. Rand sought to clarify the current state of knowledge concerning the possible impact of such a policy, and performed a preliminary quantitative analysis of the issues involved.

N-1005-NSF, *Evaluating Fuel Economy Mandates: An Exploratory Cost-Benefit Analysis*, J. P. Stucker, B. K. Burright, and W. E. Mooz, February 1980.

N-1006-DOE, *Evaluating Fuel Economy Taxes: An Exploratory Cost-Benefit Analysis*, J. P. Stucker, October 1979.

P-5858, *Modeling the Response of the Domestic Automobile Industry to Mandates for Increased Fuel Economy: An Industry Model*, J. P. Stucker, B. K. Burright, and W. E. Mooz, June 1977.

ENERGY REGULATION AND TECHNICAL CHANGE

National Science Foundation

Term and Scale of Effort: 11/73 - 4/75; 1.3 person years

Principal Investigator: Fred S. Hoffman

Rand assisted the Federal Energy Regulatory Study Team in analyzing the present energy regulatory structure and evaluating alternative means of organizing that structure. Rand also performed a case study of North Central U.S. coal resources to illustrate the numerous generic problems arising from the interaction between regulation and innovation.

R-1981-NSF/RC, *Coal Development and Government Regulation in the Northern Great Plains: A Preliminary Report*, R. D. Nehring, B. Zycher, and J. Wharton, August 1976.

ENERGY POLICY RESEARCH

Federal Energy Administration

Term and Scale of Effort: 6/74 - 10/74; 1.8 person years

Principal Investigator: Fred S. Hoffman

The Federal Energy Administration is charged with defining energy policy objectives and means to achieve them to ensure that the United States has adequate, reliable, economically efficient, and environmentally satisfactory supplies of energy. Rand identified and analyzed key energy policy alternatives and priorities.

ELECTRICITY DEMAND, SUPPLY, AND PRICING

ENERGY EFFICIENCY AND ELECTRICITY PRICING: ASSESSING THE EFFECTS OF TIME-OF-USE RATES

The Hartford Foundation, The Ford Foundation, and the National Science Foundation

Term and Scale of Effort: 6/80 - 8/83; 11.8 person years

Principal Investigator: Jan P. Acton

Because utilities supply over one-fourth of the total energy consumed in the United States and account for final energy sales of over $70 billion per year, electricity ratemaking has become an important and contentious area of public concern. With the support of three sponsors, Rand is conducting a coordinated program of research with three major components:

First, it will exploit an extensive data file compiled during a unique demonstration project—the Los Angeles Department of Water and Power (LADWP) Electricity Rate Study—to analyze the consequences of both present and alternative future rate structures. A major purpose of the research is to assess the applicability of the Los Angeles empirical findings to other areas in the United States and to test the forecasting accuracy of the models.

Second, the study will examine the actual experience of larger customers in the United States as they have come under the terms of time-of-day pricing of electricity. Actual load data on individual cystomers will be pooled across utilities, and response will be analyzed by major industrial groupings.

Third, the study will assess the benefits and costs of changing from present rates to several alternative rate structures.

The objective of the study is to develop rigorous, but understandable, methods for designing electricity rates that take better accountof the margin-

al costs of supply and the price-responsiveness of customers. The research will develop "families" of rates that are consistent with a given set of costs, and will consider such issues as whether the rates should be optional and what the standard rate level should be.

THE LOS ANGELES ELECTRICITY RATE STUDY

Los Angeles Department of Water and Power

Term and Scale of Effort: 7/75 - 6/80; 31.4 person years

Principal Investigators: Jan P. Acton and Bridger M. Mitchell

Virtually all projections of electricity demand show its use increasing both in absolute amount and in proportion to total energy consumption. Public policies with respect to the electric utility industry will therefore assume an increasingly central role in energy regulation. Rand assisted the Los Angeles Department of Water and Power in measuring the changes in energy consumption of a representative sample of the Department's customers voluntarily participating in a program of experimental tariffs. The analysis considered total energy use as well as the efficiency of energy conservation resulting from alternative rate structures, the administrative and technical feasibility of their system-wide use, and their potential applicability to other utility systems and geographic areas.

Related aspects of the study considered rate setting practice in European electric utility systems, where time-of-use pricing has been practiced for several decades. The Rand researchers also examined quantitatively the adjustments in amount and timing of electricity use by European customers who faced time of use electricity prices. These estimates were used to estimate potential energy savings in the U.S. if comparable responsiveness were demonstrated.

The Rand study also developed a methodology for improved measurement of the marginal costs of power supply under different circumstances. Those estimates were applied to the actual operation of the Los Angeles Department of Water and Power.

R-1955-DWP, *Design of the Los Angeles Peak-Load Pricing for Electricity*, W. G. Manning, B. M. Mitchell, and J. P. Acton, November 1976.

R-2031-DWP, *Peak-Load Pricing in Selected European Electric Utilities*, B. M. Mitchell and J. P. Acton, July 1977.

R-2113-DWP, *Lessons to be Learned from the Los Angeles Rate Experiment in Electricity*, J. P. Acton, W. G. Manning, and B. M. Mitchell, July 1978

R-2223-DWP, *Conducting A Survey Using the Client's Staff: Evaluation of Interviewer Performance in the Electricity Rate Study*, S. H. Berry, September 1979.

R-2278-DWP/NSF, *The Los Angeles Senior Citizen Lifeline Electricity Rate*, T. Sullivan, January 1979.

R-2425-DWP, *Seasonal Electricity Demand: A Variable Response Model*, L. Lillard and J. P. Acton, May 1980.

R-2426-DWP, *Residential Energy Demand Under Time-of-Day Pricing: Preliminary Results from the Los Angeles Rate Study*, W. G. Manning and J. P. Acton, forthcoming.

R-2430-DWP, *Sample Selection in the Los Angeles Electricity Rate Study*, W. Chow and B. M. Mitchell, July 1979.

R-2508-DOE/DWP, *British Industrial Response to Peak-Load Pricing of Electricity*, J. P. Acton, E. H. Gelbard, J. R. Hosek, and D. J. McKay, February 1980.

R-2509-DWP, *Evaluating Time-of-Day Electricity Rates for Residential Customers*, J. P. Acton and B. M. Mitchell, November 1979.

R-2588-DWP/EPRI, *Do Time-of-Use Rates Change Load Curves? And How Would You Know?*, J. P. Acton and B. M. Mitchell, May 1980.

R-2628-DWP, *Electricity Consumption by Time of Use in a Hybrid Demand System*, B. M. Mitchell and J. P. Acton, forthcoming.

N-1533-DWP, *The Effect of Time-of-Day Rates in the Los Angeles Electricity Study*, B. M. Mitchell and J. P. Acton, forthcoming.

N-1534-DWP, *Planning, Processing, and Analyzing Data for Residential Load Studies*, J. P. Acton and B. M. Mitchell, June 1980.

"Lessons to be Learned from the Los Angeles Rate Experiment in Electricity," J. P. Acton, W. G. Manning, and B. M. Mitchell, in J. L. O'Donnell (ed.), *Adapting Regulation to Shortages, Curtailment, and Inflation*, Michigan State University Public Utilities Studies, 1977.

"Charging Up for Electric Rate Reform" (editorial), J. P. Acton, *The Los Angeles Times*, November 1977.

"A Note on Modeling of Peak Electricity Demands," B. M. Mitchell, in A. Lawrence (ed.), *Forecasting and Modeling Time-of-Day and Seasonal Electricity Demands*. EPRI, December 1977.

"Peak-Load Pricing of Electricity," J. P. Acton, B. M. Mitchell, and W. G. Manning, *Journal of Business Administration*, Vol. 10, Nos. 1 and 2, July 1978.

"Do Time-of-Use Rates Change Load Curves," J. P. Acton and B. M. Mitchell, *Public Utilities Fortnightly*, May 22, 1980.

"Estimating Residential Electricity Demand Under Declining Block Tariffs: An Econometric Study Using Micro-Data," J. P. Acton, B. M. Mitchell, and R. Sohlberg, *Applied Economics*, Vol. 12, No. 2, June 1980.

Peak-Load Pricing: European Lessons for U.S. Energy Policy, B. M. Mitchell, W. G. Manning, and J. P. Acton, Ballinger, 1978.

P-5673, *The Move Towards Marginal Cost Pricing in Electricity*, J. P. Acton, June 1975 (paper delivered to national meeting of ARPA).

P-5545, *Economic Principles and the Structure of Electric Rates: Cost of Service, Allocation of Costs and Rate Design*, J. P. Acton and B. M. Mitchell, November 1975

P-5894, *Electricity Ratemaking—Overview*, J. P. Acton, May 1977.

P-5929, *European Industrial Response to Peak-Load Pricing of Electricity*, J. P. Acton, W. G. Manning, and B. M. Mitchell, March 1978 (presented to meetings of the American Economic Association and to the Canadian Electrical Association).

P-6161-1, *Peak-Load Pricing of Electricity*, J. P. Acton, B. M. Mitchell, and W. G. Manning, July 1978.

P-6422, *Gathering Information on Costs of Service: Some Basic Considerations for Implementation of PURPA*, J. P. Acton, F. A. Camm, and D. J. McKay, October 1979.

P-6456, *Electricity Prices and the Poor: What are the Effects and What Can We Do?*, J. P. Acton, March 1980.

P-6483, *Contacting and Interviewing Residential Electricity Customers*, S. H. Berry, March 1980.

NEW TOOLS AND STRATEGIES FOR OPERATIONAL PLANNING

Los Angeles Department of Water and Power

Term and Scale of Effort: 8/80 – 8/82; 4.3 person years

Principal Investigator: Derek J. McKay

Providing electricity reliably and at minimum cost requires that an electric utility make many decisions. As these decisions are frequently based on uncertain data, an important issue in the decision process is the proper treatment of uncertainty.

Working with engineers at the Los Angeles Department of Water and Power (DWP), staff are developing a consistent set of computer models with an improved uncertainty component. The models are intended to answer a variety of operational questions in such areas as fuel purchases, contract negotiations, seasonal hydro-thermal dispatch policies, electrical supply system maintenance scheduling, startup and shutdown of electric generating equipment, interchanges and purchases of electricity, and the efficient utilization of hydro resources in the DWP system.

FORECASTING INDUSTRIAL RESPONSE TO PEAK-LOAD PRICING OF ELECTRICITY

Electric Power Research Institute

Term and Scale of Effort: 10/78 – 4/80; 2.4 person years

Principal Investigator: Jan P. Acton

Interest in the use of peak-load pricing and co-generation of electricity has been increasing in the United States for several years. Europe has had more experience with these arrangements than the United States, suggesting that a better understanding of the European experience can enhance (a) plans for U.S. implementation and (b) forecasts of the effects on U.S. industrial firms and utilities. Extending prior Rand research on these topics, Rand staff gathered data from the United Kingdom, France and other countries to assess the transferability of European experience to the United States, and to further document firm-specific industrial response to peak-load pricing in Europe.

R-2588-DWP/EPRI, *Do Time-of-Use Rates Change Load Curves? And How Would You Know?*, J. P. Acton and B. M. Mitchell, May 1980.

R-2619-EPRI, *Industrial Co-Generation in Sweden under Market Oriented Pricing*, F. A. Camm, forthcoming.

P-6423, *Introduction of Peak-Load Pricing in Europe*, D. J. McKay, October 1979.

VARIABLE RESPONSE MODELS OF THE DEMAND FOR ELECTRICITY BY TIME OF DAY

Electric Power Research Institute

Term and Scale of Effort: 10/78 – 12/80; 1.3 person years

Principal Investigator: Lee Lillard

Rand staff developed an accurate bias free econometric model of the household demand for electricity as an aid in the analysis of residential electricity conservation problems. The variable response model considers weather conditions, household income, stock of energy-using consumer durables, family size, and other demographic characteristics.

MANAGEMENT OF THE ELECTRICITY SECTOR ABROAD

State of California (Energy Resources Conservation and Development Commission)

Term and Scale of Effort: 4/76 – 2/77; .4 person years

Principal Investigator: Bridger M. Mitchell

The sharp increase in the cost of supplying electricity, the heightened concern about the environmental and public safety aspects of siting and operating new generating plants, and the desire to use energy more efficiently have motivated the search for ways to regulate the electricity sector in California. In this project, Rand reviewed and assessed the experience of utilities, regulatory bodies, and major industries in a number of advanced industrial countries in an effort to identify regulatory, technological, and economic practices that are proving successful in conserving electricity. The information obtained in this review was then used in a preliminary study of the applicability and estimated effectiveness of these techniques in California. The project concentrated on three interrelated policies—conservation requirements, use of load management technology, and peak-load pricing.

R-2106-CERCDC, *Electricity Pricing and Load Management: Foreign Experience and California Opportunities*, B. M. Mitchell, W. G. Manning, and J. P. Acton, February 1977.

Peak-Load Pricing: European Lessons for U.S. Energy Policy, B. M. Mitchell, W. G. Manning, and J. P. Acton, Ballinger 1978.

REGULATORY IMPLICATIONS AND DISTRIBUTIONAL IMPACT OF PRICE CHANGES ON RESIDENTIAL ENERGY DEMAND

National Science Foundation

Term and Scale of Effort: 12/74 – 4/78; 5.8 person years

Principal Investigator: Jan P. Acton

Municipal utilities and regulatory agencies at all levels of government are considering ways of revising electrical rate structures to save energy. To assist them in forecasting the probable impact of alternative pricing policies (lifeline rates, rate flattening, and peak-load pricing), Rand studied the effects of such changes in the level and structure of prices for electricity and other forms of energy on the household use of energy. Analysis of the effects of rate flattening and lifeline rates indicated little change in the quantity of electricity demanded by households with low levels of consumption, while giving them a break in the bill. Peak-load pricing analysis for manufacturing customers indicated that $0.4 to $1.8 billion could be saved per year in utility operating costs. With a more efficient mix of operating and capital costs, savings of $1.3 to $3.5 billion per year could be achieved if U.S. manufacturing customers

were to demonstrate the same pattern of response as their European counterparts.

R-1899-NSF, *Residential Demand for Electricity in Los Angeles: An Econometric Study of Disaggregated Data*, J. P. Acton, B. M. Mitchell, and R. S. Mowill, September 1976.

R-2278-DWP/NSF, *The Los Angeles Senior Citizen Lifeline Rate*, T. Sullivan, December 1978.

"Estimating Residential Electricity Demand Under Declining Block Tariffs: An Econometric Study Using Micro-Data," J. P. Acton, B. M. Mitchell, and R. Solhberg, *Applied Economics*, Vol. 12, No. 2, June 1980.

"Regulatory Rationing of Electricity Under a Supply Curtailment," J. P. Acton and R. S. Mowill, *Land Economics*, Vol. 52, No. 4, November 1976.

Peak-Load Pricing: European Lessons for U.S. Energy Policy, B. M. Mitchell, W. G. Manning, and J. P. Acton, Ballinger, 1978.

P-5544, *Selected Econometric Studies of the Demand for Electricity: Review and Discussion*, B. M. Mitchell, J. P. Acton, and R. S. Mowill, November 1975.

P-6203, *Estimating Residential Electricity Demand Under Declining Block Tariffs: An Econometric Study Using Micro-Data*, J. P. Acton, B. M. Mitchell, and R. Solhberg, November 1978.

P-6456, *Electricity Prices and the Poor: What are the Effects and What Can We Do?*, J. P. Acton, March 1980.

ELECTRICITY CONSERVATION MEASURES IN THE COMMERCIAL SECTOR: THE LOS ANGELES EXPERIENCE

Federal Energy Administration

Term and Scale of Effort: 5/74 – 2/75; .8 person years

Principal Investigator: Jan P. Acton

The City of Los Angeles was uniquely successful in dealing with the fuel shortage of the winter of 1973-1974. A city ordinance required residential and industrial customers of the Los Angeles Department of Water and Power to cut their energy usage by 10 percent, and commercial customers to reduce theirs by 20 percent, or face a 50 percent surcharge on their entire bill for the first violation and a service cutoff for subsequent violations. Customers responded rapidly, and total energy demand dropped by 17 percent instead of the expected 12 percent. Rand investigated Los Angeles' experience and analyzed its applicability to other areas.

R-1592-FEA, *Electricity Conservation Measures in the Commercial Sector: The Los Angeles Experience*, J. P. Acton, M. H. Graubard, and D. J. Weinschrott, September 1974.

R-1650-FEA, *Conserving Electricity by Ordinance: A Statistical Analysis*, J. P. Acton and R. S. Mowill, February 1975.

P-5624, *Regulatory Rationing of Electricity Under a Supply Curtailment*, J. P. Acton and R. S. Mowill, April 1976.

P-6004, *Curtailment Ordinances as an Approach to Electricity Shortages*, J. P. Acton, September 1977.

NUCLEAR FUEL CYCLE ISSUES

ASSESSMENT OF NUCLEAR SUPPLY SYSTEMS FOR INTERNATIONAL COMMERCE

Department of Energy

Term and Scale of Effort: 9/77 – 4/80; 7.6 person years

Principal Investigators: William R. Harris and Kenneth A. Solomon

For more than two decades Rand has been concerned with the links between nuclear power generation and nuclear weapons. As part of the Nonproliferation Alternative Systems Assessment Program (NASAP) conducted by the U.S. Department of Energy, Rand staff assessed international arrangements to restrain weapons proliferation resulting from nuclear fuel cycle activities. Topics included international nuclear fuel service centers, the use of sanctions to deter proliferation, international arrangements for enrichment, Soviet Union policies for nuclear exports, terrorism and other subnational issues affecting nuclear power systems, and international cooperation in managing spent fuel.

R-2362-DOE, *Soviet Nuclear Power and Nuclear Exports*, G. Duffy, December 1979.

R-2427-D0E, *International Arrangements for Uranium Enrichment*, M. D. Mihalka, M. M. Miller, and K. A. Solomon, September 1979.

P-5792, *Nuclear Responsibility and Nuclear Trade: International Rules and Institutions to Manage Nuclear Fuel Cycles*, W. R. Harris, January 1977.

P-5889, *Legislative Imperatives for California—New Criteria for Nuclear Fuel Cycel Licensing in the Light of U.S. Antiproliferation Policies*, W. R. Harris, June 1977 (testimony before the California Energy Resources Conservation and Development Commission).

P-5930, *International Nuclear Service Centers: A Bibliography*, G. M. Petty and M. Yokota, March 1978.

P-5953, *International Institutions for Nuclear Energy: Issues of Assessment and Design*, W. R. Harris, April 1978.

P-6216, *Rules-of-Trade for International Nuclear Commerce*, W. R. Harris, July 1978.

P-6219, *NEWS (Nuclear Energy, Weapons and Safeguards) Data Base: A Computerized Bibliography, 1975-April 1978*, G. M. Petty, M. Yokota, W. R. Harris, M. D. Mihalka, and K. A. Solomon, October 1978.

P-6219/1, *NEWS (Nuclear Energy, Weapons and Safeguards) Data Base: A Computerized Bibliography; Supplement to*
P-6219, G. M. Petty, S. Ritter, W. R. Harris, M. D. Mihalka, and K. A. Solomon, July 1979.

P-6226, *Reprocessing of Nuclear Fuel and Plutonium Breeder Commercialization: Implications of Deferral*, W. D. Perry, November 1978.

P-6308, *International Cooperation in Nuclear Fuel Services: European and American Approaches*, H. Mendershausen, December 1978.

COST COMPARISONS OF BREEDER AND LIGHT WATER NUCLEAR REACTORS

Arms Control and Disarmament Agency

Term and Scale of Effort: 8/78 – 3/79; 1 person year

Principal Investigator: William E. Mooz

Capial costs will be the most important factor in determining the economic competitiveness of nuclear breeder reactors. Rand staff obtained capital cost estimates for three proposed liquid metal fast breeder reactors and for contemporary light water reactors, and used these data to project comparative costs of both reactors. These results contributed to the analysis of the need and timing for breeder reactors, conducted as part of the International Nuclear Fuel Cycle Evaluation.

R-2441-ACDA, *A Comparison of the Capital Costs of Light Water Reactor and Liquid Metal Fast Breeder Reactor Power Plants*, W. E. Mooz and S. Siegel, February 1979.

BREEDER REACTOR SAFETY ISSUES

Department of Energy

Term and Scale of Effort: 5/77 – 4/81; 3.1 person years

Principal Investigator: Kenneth A. Solomon

To assist DOE in the development of a safety program for the liquid metal fast breeder reactor (LMFBR), Rand is undertaking two closely related tasks: (1) an assessment of risk criteria for the LMFBR and comparison with current criteria for light water reactors; and (2) identification of the objectives and functional requirements of an LMFBR safety research program.

R-2409-RC, *The Index of Harm: A Measure for Comparing Occupational Risk Across Industries*, K. A. Solomon and S. C. Abraham, June 1979.

N-1188-DOE, *Anticipated Transients Without SCRAM for Light Water Reactors: Implications for Liquid Metal Fast Breeder Reactors*, W. E. Kastenberg and K. A. Solomon, July 1979.

N-1559-DOE, *Some Implications of the Three Mile Island Accident for LMFBR Safety and Licensing: The Design Basis Issue*, K. A. Solomon, August 1980.

HIGH-TEMPERATURE, GAS-COOLED REACTOR SAFETY REVIEW

Gas Cooled Reactor Associates

Term and Scale of Effort: 4/80 – 11/80; .3 person years

Principal Investigator: Kenneth A. Solomon

This study reviewed safety assessments of the high-temperature, gas-cooled reactor (HTGR), for a general policy audience rather than technical specialists. It also assessed the impact of the accident at the Three Mile Island nuclear power plant on HTGR design issues.

OCEAN DISPOSAL OF RADIOACTIVE WASTES

National Oceanic and Atmospheric Administration

Term and Scale of Effort: 8/79 – 3/81; 1.3 person years

Principal Investigator: Kenneth A. Solomon

Rand is examining requirements for monitoring deep-sea waste storage sites for both low-level and high-level radioactive wastes. The research is conducted as part of the federal multi-agency Nuclear Waste Management Program.

VOTER ATTITUDES AND CHOICE ON THE CALIFORNIA NUCLEAR ENERGY INITIATIVE

National Science Foundation

Term and Scale of Effort: 3/76 - 7/78; 2.7 person years

The Ford Foundation

Term and Scale of Effort: 6/76 - 1/78; .4 person years

Principal Investigator: Deborah R. Hensler

In June 1976, California voted on a Nuclear Power Initiative which would have halted construction of new nuclear power plants and cut back operations at existing plants in the State. Based on a survey of California adults before and after the election, Rand analyzed the nature and distribution of public attitudes toward nuclear energy prior to the campaign, the factors influencing individuals' actual voting decisions, and the national implications of the California election.

R-2341/1-NSF/FF, *Evaluating Nuclear Power: Voter Choice on the California Nuclear Power Initiative—Executive Summary*, D. R. Hensler and C. P. Hensler, July 1979.

R-2341/2-NF/FF, *Evaluating Nuclear Power: Voter Choice on the California Nuclear Energy Initiative*, D. R. Hensler and C. P. Hensler, July 1979.

R-2341/3-NF/FF, *Evaluating Nuclear Power: Voter Choice on the California Nuclear Energy Initiative—Technical Appendices*, D. R. Hensler and C. P. Hensler, July 1979.

THE COMMERCIAL DEVELOPMENT OF THE LIGHT WATER REACTOR

National Science Foundation

Term and Scale of Effort: 7/75 - 7/77; 4.3 person years

Principal Investigator: Robert L. Perry

The development of the light water reactor in the United States is viewed in many respects as a model of the future commercialization of other, more advanced types of nuclear reactors. Rand examined the complex interaction of technological, institutional, environmental, and economic factors that affected light water reactor commercialization. This project aimed to provide government, industry and utility decisionmakers with previously inaccessible information concerning the influences on and processes of nuclear reactor commercialization, the effects of various policy alternatives, and the appropriateness of commercialization approaches for other new energy technologies.

R-2104-NSF, *Regulation of Nuclear Power: The Case of the Light Water Reactor*, E. S. Rolph, June 1977.

R-2116-NSF, *Nuclear Reactors for Generating Electricity: U.S. Development from 1946 to 1963*, W. A. Allen, June 1977.

R-2148-NSF, *Electric Utility Decisionmaking and the Nuclear Option*, A. Gándara, June 1977.

R-2180-NSF, *Development and Commercialization of the Light Water Reactor, 1946-1976*, R. L. Perry et al., June 1977.

Development and Diffusion of the Nuclear Power Reactor: A Comparative Analysis, P. deLeon, Ballinger, 1979.

Nuclear Power and the Public Safety: A Study in Regulation, E. S. Rolph, Lexington Books, D. C. Heath and Company, 1978.

P-5715, *Lessons from Early Experience in Reactor Development*, W. A. Allen, September 1976.

P-5739, *A Cross-National Comparison of Nuclear Reactor Development Strategies*, P. deLeon, October 1976.

P-6115, *A Comparative Analysis of High Technology Programs: The Development and Diffusion of the Nuclear Power Reactor in Six Nations*, P. deLeon, August 1978.

P-6115/1, *References for a Comparative Analysis of High Technology Programs: The Development and Diffusion of the Nuclear Power Reactor in Six Nations*, P. deLeon, August 1978.

INSTITUTIONAL ALTERNATIVES FOR LIQUID METAL FAST BREEDER REACTOR DEVELOPMENT AND COMMERCIALIZATION

National Science Foundation

Term and Scale of Effort: 12/75 – 1/77; 1 person year

Principal Investigator: Leland L. Johnson

Enormous funding needs, technical uncertainties, the price of uranium fuel, the demand for electrical power, availability of alternative power sources, problems of safety and safeguards in handling plutonium, and environmental concerns are among the many factors that will affect the development and commercialization of the liquid metal fast breeder reactor (LMFBR). Rand staff conducted case studies of other large technology developments and assessed their institutional implications for the LMFBR program.

R-2069-NSF, *Alternative Institutional Arrangements for Developing and Commercializing Breeder Reactor Technology*, L. L. Johnson, E. W. Merrow, W. S. Baer, and A. J. Alexander, November 1976.

THERMAL PERFORMANCE OF GAS-COOLED FAST BREEDER REACTORS

Electric Power Research Institute

Term and Scale of Effort: 5/75 – 8/76; 4 person years

Principal Investigator: Carl Gazley, Jr.

This work focused on developing a capability for independent technical evaluation of the thermal performance of currently conceived gas-cooled fast breeder reactors, enabling the identification and technical appraisal of criticial problems related to cooling-system performance and safety. Rand performed the research in close consultation with the Electric Power Research Institute, using available information from Atomic Energy Commission and foreign laboratories.

R-1978-EPRI, *Prediction of Thermal-Hydraulic Performance of Gas-Cooled Fast Breeder Reactors*, C. Gazley, Jr., G. M. Harpole, L. S. Yao, W. H. Krase, I. Catton, J. Grzesik, and W. Matyskiela, January 1977.

OTHER ENERGY TOPICS

THE DISCOVERY OF SIGNIFICANT OIL AND GAS FIELDS IN THE UNITED STATES

Department of the Interior (Geological Survey)

Term and Scale of Effort: 6/77 – 11/80; 1.2 person year

Principal Investigator: Richard D. Nehring

The estimation of remaining oil and gas resources is of major importance in determining U.S. energy policy. Rand staff collected data on known oil and gas fields in the United States and their discovery patterns. These data were then used to estimate remaining U.S. resources.

R-2654-USGS, *The Discovery of Significant Oil and Gas Fields in the United States*, R. D. Nehring, forthcoming.

P-6413, *The Outlook for Conventional Petroleum Resources*, R. D. Nehring, November 1979.

ENVIRONMENTAL EFFECTS OF THE REJECTION OF WASTE HEAT FROM LARGE ELECTRIC POWER PLANTS

Department of Energy

Term and Scale of Effort: 2/76 – 6/80; 4.3 person years

Principal Investigators: L. Randall Koenig and Francis W. Murray

The production of electrical power is an inefficient process—twice as much energy is wasted as is produced for useful purposes. Modern plants normally dissipate their wasted energy directly into the atmosphere in the form of heat and water vapor, which in natural atmospheric processes leads to cloud formation and rain. While existing electric-power generating facilities have little adverse effect on the environment, there is evidence that much larger power complexes would have an appreciable ability to affect local weather. Rand staff quantitatively assessed the effects of rejecting waste heat directly into the atmosphere through the study of analogous events observed in nature.

R-2456-DOE, *Simulation of Convective Cloudiness, Rainfall, and Associated Phenomena Caused by Industrial Heat Released Directly to the Atmosphere*, F. W. Murray and L. R. Koenig, June 1979.

R-2465-DOE, *Anomalous Cloudiness and Precipitation Caused by Industrial Heat Rejection*, L. R. Koenig, September 1979.

N-1443-DOE, *The Climatic Probability of Snowfall Induced by Cooling-Tower Plumes*, F. W. Murray, January 1980.

N-1479-DOE, *Anomalous Snowfall Caused by Natural-Draft Cooling Towers*, L. R. Koenig, May 1980.

P-6041, *Numerical Simulation of an Industrial Cumulus and Comparison with Observations*, F. W. Murray, L. R. Koenig, and P. M. Tag, November 1977.

ASSESSMENT OF CLOSED-CYCLE MAGNETOHYDRODYNAMICS

Department of Energy

Term and Scale of Effort: 4/76 – 12/79; 4.8 person years

Principal Investigator: Richard Y. Pei

Rand conducted an independent evaluation of the closed-cycle magnetohydrodynamics (MHD) power generation system in the overall context of advanced energy conversion technologies. In addition to analyzing MHD programs, Rand staff coordinated study teams of U.S. and foreign experts, and held a series of conferences on MHD power generation. The results have been used to assist the Energy Research and Development Administration and the Department of Energy in formulating policies for MHD research and development.

R-2127-ERDA, *Proceedings of the Rand Corporation Conference on MHD Power Generation, June 29-July 1, 1976*, R. Y. Pei and S. Purnell, May 1977.

R-2128-ERDA, *The Noble-Gas Closed-Cycle System of Magnetohydrodynamic Power Generation*, R. Y. Pei and R. W. Hess, August 1977.

R-2290-DOE, *Proceedings of the Rand Corporation Conference on Liquid-Metal MHD Power Generation, September 19-20, 1977*, R. Y. Pei and S. W. Purnell, August 1978.

R-2338-DOE, *Proceedings of the Closed-Cycle MHD Specialists' Meeting, March 30-31, 1978*, R. Y. Pei and S. W. Purnell, December 1978.

R-2343-DOE, *The Liquid-Metal Closed-Cycle System of Magnetohydrodynamic Power Generation*, R. Y. Pei and R. W. Hess, December 1978.

THE DEVELOPMENT OF POLICY OPTIONS FOR U.S.-JAPANESE COOPERATION IN ENERGY RESEARCH AND DEVELOPMENT

Sumitomo Fund

Term and Scale of Effort: 1/76 – 4/77; .3 person years

Principal Investigator: Paul F. Langer

This study, drawing on earlier technological, economic, and institutional research conducted by Rand and its Japanese counterparts, aimed to further cooperation between the United States and Japan in a field of growing significance to the economic, social, and political development of the two countries. The policy paper developed during the course of the study was distributed to the relevant U.S. and Japanese government agencies, decisionmakers, economists, and the interested public.

P-5843, *U.S.-Japanese Cooperation in Energy Research and Development*, P. F. Langer, April 1977.

ENERGY ALTERNATIVES FOR CALIFORNIA

State of California (Resources Agency and Assembly) and The Rockefeller Foundation

Term and Scale of Effort: 9/71 – 12/75; 11.4 person years

Principal Investigators: Ronald D. Doctor and Deane N. Morris

Rand's research on energy resources management for the State of California was supported in part by grants from the Rockefeller Foundation and the National Science Foundation. Results of early studies were summarized in a series of reports on the supply and demand of electricity in California, which

served as the basis of hearings conducted in 1973 by the Assembly Subcommittee on State Energy Policy. One of the bills subsequently introduced in the legislature was enacted into law in May 1974 as the Warren-Alquist Act. Based largely on Rand's analysis and recommendations, the Act established a full-time commission charged with energy planning and management for the State.

Subsequent work for the California Assembly extended the analysis to consideration of all forms of energy, investigating sources and uses of energy in California, costs and benefits of energy-conserving measures and policies, government intervention in dealing with energy shortages or emergencies, and federal and state interaction on energy issues.

R-990-NSF/CSA, *Some Implications of Policies To Slow the Growth of Electricity Demand in California*, K. P. Anderson, December 1972.

R-991-NSF/CSRA, *A Methodology for Projecting the Electrical Energy Demand of the Manufacturing Sector in California*, W. E. Mooz and C. C. Mow, January 1973.

R-992-RF, *Environmental Factors in the Production and Use of Energy*, S. H. Dole and R. A. Papetti, January 1973.

R-995-NSF/CSRA, *A Methodology for Projecting the Electrical Energy Demand of the Residential Sector in California*, C. C. Mow, W. E. Mooz, and S. K. Anderson, March 1973.

R-1050-NSF/CSA, *The Impact of Electricity Price Increases on Income Groups: Western United States and California*, M. B. Berman, M. J. Hammer, and D. P. Tihansky, November 1972.

R-1084-NSF/CSRA, *California's Electricity Quandary: I, Estimating Future Demand*, W. E. Mooz and C. C. Mow, September 1972.

R-1086-RF/CSA, *The Dry/Spray Tower: A Power Plant Cooling Tower Concept for Semi-Arid Locations*, R. G. Salter, January 1973.

R-1087-RF/CSA, *Electricity Generating Cost Model for Comparison of California Power Plant Siting Alternatives*, R. L. Petruschell and R. G. Salter, January 1973.

R-1102-NSF/CSA, *The Impact of Electricity Price Increases on Income Groups: A Case Study of Los Angeles*, M. B. Berman and M. J. Hammer, March 1973.

R-1106-NSF/CSRA, *A Methodology for Projecting the Electrical Energy Demand of the Commercial Sector in California*, W. E. Mooz and C. C. Mow, March 1973.

R-1107-NSF/CSRA, *A Methodology for Projecting the Electrical Energy Demand in California: A User's Guide to the Model*, S. K. Anderson, March 1973.

R-1115-RF/CSA, *California's Electricity Quandary: II, Planning for Power Plant Siting*, R. H. Ball, R. G. Salter, S. H. Dole, B. Frederich, M. J. Hammer, W. E. Mooz, R. A. Papetti, and G. Richards, September 1972.

R-1116-NSF/CSA, *California's Electricity Quandary: II, Slowing the Growth Rate*, R. D. Doctor, K. P. Anderson, M. B. Berman, S. H. Dole, M. J. Hammer, P. T. McClure, and C. B. Smith, September 1972.

R-1128-RF/CSA, *Air Pollution and Power Plant Siting in California*, R. A. Papetti, S. H. Dole, and M. J. Hammer, March 1973.

R-1793-CSA/RF, *Energy Alternatives for California: Paths to the Future*, W. R. Ahern, R. D. Doctor, W. R. Harris, A. J. Lipson, D. N. Morris, R. D. Nehring, J. C. De Haven, M. H. Graubard, D. L. Jaquette, A. D. Lee, W. E. Mooz, R. G. Salter, and K. A. Wolf, December 1975.

R-1793/1-CSA/RF, *Energy Alternatives for California: Paths to the Future, Executive Summary*, W. R. Ahern, R. D. Doctor, W. R. Harris, A. J. Lipson, D. N. Morris, and R. D. Nehring, December 1975.

R-1850-CSA/RF, *Oil and Gas Supplies for California: Past and Future*, R. D. Nehring, December 1975.

ENERGY AND AIR QUALITY IN CALIFORNIA

State of California (Air Resources Board)

Term and Scale of Effort: 8/76 – 10/77; .7 person years

Principal Investigators: William R. Harris and Richard D. Nehring

Energy developments in California have major implications for air quality. To assist the California Air Resources Board in developing strategies for maintaining and enhancing air quality, Rand identified those energy policies which may noticeably affect air emissions, and projected oil and natural gas production and consumption for California.

OFFSHORE OIL AND GAS LEASING ISSUES

State of California

Term and Scale of Effort: 1/75 – 3/75; .3 person years

Principal Investigator: Fred S. Hoffman

As part of a program to increase the acreage on federally owned offshore lands leased to the petroleum industry for oil and gas exploration and development, the U.S. Department of the Interior planned 24 lease sales during 1975 through 1978. Rand provided background information and analysis to the California Governor's staff to help them formulate positions on the program

in general and on leasing offshore California in particular. The work related the offshore development issue to a number of state concerns, including prices of energy to California consumers, costs of energy to California energy supply companies, reliability of energy sources, environmental damages, and petroleum industry employment and expenditures in California.

HEALTH SCIENCES

Albert P. Williams, Program Director

Rand's health research emphasizes multidisciplinary analysis in a wide range of problem areas. Physicians, social scientists, biomedical scientists, engineers, mathematicians, and statisticians collaborate on a variety of research projects funded by contracts and grants from the federal government, from private foundations, and from Rand's own corporate resources.

For several years, Health Sciences has been one of the largest of Rand's research programs. The program currently receives $5-6 million in external funding per year, providing for a level of research effort of 70-80 full-time-equivalent professionals.

Early policy research enabled Rand to obtain, in 1971, a large grant to conduct the Health Insurance Study (HIS), a large-scale social experiment designed to evaluate the effects of alternative methods of financing national health care. The experiment, which involves some 2,750 families in six sites around the country, was undertaken to estimate how alternative cost-sharing arrangements and other factors affect individuals' demand for health care, the quality of care they receive, and their health status. The experimental activities will end in 1982, but Rand's analysis of the data will continue at least through 1983.

Building on the HIS experience, Rand researchers have designed several experimental studies to address important health policy questions. One such study is an evaluation of a school-based preventive dental health program being conducted in collaboration with the American Fund for Dental Health. Another study, for the Food and Drug Administration, evaluates alternative approaches to educating patients about prescription drugs.

In 1972, Rand researchers began a large study to assess the effects of federal programs on academic health centers. This work involved ten medical schools and their affiliated hospitals and research institutes. It dealt with such topics as medical school admissions, student performance, the cost of care in teaching hospitals, institutional budgeting processes, and the biomedical research awards process. Current work in this area

examines the effects of expanding medical school output on the geographic and specialty distributions of U.S. physicians.

Rand research on the quality of medical care increased in the early 1970s, requiring greater inputs from physician researchers. To provide an environment where physician researchers can maintain their involvement with clinical and academic medicine, Rand became affiliated with the UCLA School of Medicine in 1975. Most of the physicians on Rand's health program staff hold faculty appointments at UCLA, and collaboration between the two institutions has grown steadily.

Rand's major new health research initiative is in the area of care for the elderly. Studies in this area deal with health manpower requirements resulting from the changing age distribution of the U.S. population, medical peer group assessment of quality of care in nursing homes, and ways to improve the accuracy of prognoses for nursing home patients.

The biomedical modeling component of health sciences research focuses on the development of mathematical models describing the chemical and physical processes of disease and treatment. Studies deal with such subjects as the fluid mechanics of sickle cells in the capillaries and determinants of the resistance of normal and tumor cells to cancer chemotherapy.

Rand's multidisciplinary environment attracts collaborators from university health science centers who have ready access to laboratories and clinical facilities and who may bring different perspectives to basic science as well as to policy research. At present, Rand health researchers are collaborating with faculty members at Stanford, Yale, Columbia, Tufts, the University of Southern California, Indiana University, the M. D. Anderson Hospital and Tumor Institute (University of Texas), and the University of California at Berkeley, as well as UCLA.

Marshall A. Rockwell was Director of the Health Sciences Program until 1976, when Albert P. Williams became Program Director.

HEALTH INSURANCE STUDIES

HEALTH INSURANCE STUDY

Department of Health and Human Services (Assistant Secretary for Planning and Evaluation) (begun under Office of Economic Opportunity)

Term and Scale of Effort: 4/73 – 10/81; 250.2 person years

Principal Investigator: Joseph P. Newhouse

In 1971, under a grant from the Office of Economic Opportunity (see below), Rand began a program of analysis designed to determine the potential effects of alternative methods of financing health care. Research conducted during 1971-1973 relied upon the use of non-experimental data to predict the costs, consumption, and distribution of health services among various income groups under alternative insurance plans. This early research led to the implementation of a large-scale, controlled experiment to obtain policy-relevant information not available through the analysis of non-experimental data alone. The experiment which Rand is now conducting for HHS involves the enrollment of some 7700 individuals in 2750 families in a number of experimental insurance plans. The six sites chosen for enrollment are Dayton, Ohio; Seattle, Washington; Fitchburg and Franklin County, Massachusetts; and Charleston and Georgetown County, South Carolina. The study is primarily intended to assess the many potential effects of variation in the cost of health services. It is not a pilot test or demonstration project for one type of national health insurance, nor does it attempt to alter the health care delivery system. The experiment was undertaken to increase the objective information needed to make decisions regarding future national health policy. Its specific objectives are:

- To estimate how alternative cost-sharing arrangements affect the demand for health care services.
- To assess the impact of varying the cost of health services on the health status of individuals.
- To determine whether (and by how much) cost-sharing arrangements affect low-income families more than higher-income families.
- To ascertain how the ambulatory care system can accommodate to varying levels of demand or stress.
- To gain familiarity with the difficulties of administering health insurance plans that place a ceiling on out-of-pocket payments by the family.
- To learn how the quality of medical care received differs (if at all) among individuals who have various insurance plans.
- To compare utilization, quality of care, health status outcomes, and consumer satisfaction in an existing prepaid group practice with the fee-for-service system.

R-964-1-OEO/NC, *Coinsurance and the Demand for Medical Services*, C. E. Phelps and J. P. Newhouse, October 1974.

R-965-1-OEO, *The Health Insurance Study—A Summary*, J. P. Newhouse, March 1974.

R-1149-1-NC, *On Having Your Cake and Eating It Too: Econometric Problems in Estimating the Demand for Health Services*, J. P. Newhouse, C. E. Phelps, and M. S. Marquis, October 1979.

R-1197-NC/OEO, *Price and Income Elasticities for Medical Care Services*, J. P. Newhouse and C. E. Phelps, June 1974.

R-1216-OEO, *Mental Health, Dental Services, and Other Coverage in the Health Insurance Study*, L. A. Clasquin, November 1973.

R-1222-OEO, *Health and Taxes: An Assessment of the Medical Deduction*, B. M. Mitchell and R. J. Vogel, August 1973.

R-1281-OEO, *Welfare Analysis of Changes in Health Coinsurance Rates*, K. J. Arrow, November 1973.

R-1393-HEW, *The Choice Between Family and Individual Deductibles in Health Insurance*, E. B. Keeler, D. A. Relles, and J. E. Rolph, October 1975.

R-1484-OEO, *Issues in the Analysis and Design of the Experimental Portion of the Health Insurance Study*, J. P. Newhouse, June 1974.

R-1509-HEW, *Employer-Paid Group Health Insurance and the Costs of Mandated National Coverage*, B. M. Mitchell and C. E. Phelps, September 1975.

R-1514-OEO/NC, *Deductibles and the Demand for Medical Services: The Theory of the Consumer Facing a Variable Price Schedule Under Uncertainty*, E. B. Keeler, J. P. Newhouse, and C. E. Phelps, December 1974.

R-1528-HEW/OEO, *Policy Options and the Impact of National Health Insurance*, J. P. Newhouse, C. E. Phelps, and W. B. Schwartz, June 1974.

R-1602-HEW, *Rules of Operation for the Health Insurance Study*, L. A. Clasquin, and M. E. Brown, May 1977.

R-1626-OEO, *Health Status Age: An Age Predictive Health Status Index*, A. F. Abrahamse and A. I. Kisch, June 1975.

R-1635-OEO, *Forecasting Demand for Medical Care for the Purpose of Planning Health Services*, J. P. Newhouse, December 1974.

R-1658-HEW, *Evaluating Quality of Health Care for the Disadvantaged: A Literature Review*, R. H. Brook and K. N. Williams, November 1975.

R-1661-HEW, *An Estimate of the Impact of Deductibles on the Demand for Medical Care Services*, J. P. Newhouse, J. E. Rolph, B. M. Mori, and M. Murphy, October 1978.

R-1698-HEW, *Foreign Medical Graduates and Their Effects on the Quality of Medical Care in the United States*, K. N. Williams and R. H. Brook, January 1976.

R-1711-HEW, *The Financing of National Health Insurance*, B. M. Mitchell and W. B. Schwartz, May 1976.

R-1883-HEW, *The Measurement of Expenditures for Outpatient Physician and Dental Services: Methodological Findings from the Health Insurance Study*, K. H. Marquis, M. S. Marquis, and J. P. Newhouse, April 1976.

R-1939-HEW, *Mechanisms for Assuring Quality of U. S. Medical Care Services: Past, Present, and Future*, R. H. Brook and A. Davies-Avery, August 1977.

R-1958-HEW, *The Demand for Supplementary Health Insurance, or Do Deductibles Matter?*, E. B. Keeler and J. P. Newhouse, July 1976.

R-1987/1-HEW, *Conceptualization and Measurement of Health for Adults in the Health INsurance Study: Vol. I, Model of Health and Methodology*, J. E. Ware, Jr., R. H. Brook, A. Davies-Avery, K. N. Williams, A. L. Stewart, W. H. Rogers, C. A. Donald, and S. A. Johnston, May 1980.

R-1987/2-HEW, *Conceptualization and Measurement of Health for Adults in the Health Insurance Study: Physical Health in Terms of Functioning*, A. L. Stewart, J. E. Ware, Jr., R. H. Brook, and A. Davies-Avery, July 1978.

R-1987/3-HEW, *Conceptualization and Measurement of Health for Adults in the Health Insurance Study: Vol. III, Mental Health*, J. E. Ware, Jr., S. A. Johnston, A. Davies-Avery, and R. H. Brook, December 1979.

R-1987/4-HEW, *Conceptualization and Measurement of Health for Adults in the Health Insurance Study: Vol. IV, Social Health*, C. A. Donald, J. E. Ware, Jr., R. H. Brook, and A. Davies-Avery, August 1978.

R-1987/5-HEW, *Conceptualization and Measurement of Health for Adults in the Health Insurance Study: Vol. V, General Health Perceptions*, J. E. Ware, Jr., A. Davies-Avery, and C. A. Donald, September 1978.

R-1987/7-HEW, *Conceptualization and Measurement of Health for Adults in the Health Insurance Study: Vol. VII, Power Analysis of Health Status Measures*, W. H. Rogers, K. N. Williams, and R. H. Brook, March 1979.

R-1987/8-HEW, *Conceptualization and Measurement of Health for Adults in the Health Insurance Study: Vol. VIII, Overview*, R. H. Brook, J. E. Ware, Jr., A. Davies-Avery, A. L. Stewart, C. A. Donald, W. H. Rogers, K. N. Williams, and S. A. Johnston, October 1979.

R-2066-HEW, *The Relationship Between Medical Resources and Measures of Health: Some Additional Evidence*, J. P. Newhouse and L. J. Friedlander, May 1977.

R-2088-HEW, *Survey Measurement Design and Evaluation Using Reliability Theory*, K. H. Marquis and M. S. Marquis, June 1977.

R-2101-HEW, *The Health Insurance Study Screening Examination Procedures Manual*, L. H. Smith, G. A. Goldberg, R. H. Brook, and L. Tosi, September 1978.

R-2107-HEW, *Measurement Evaluation of the Health Insurance Study Screening Interview*, M. S. Marquis and K. H. Marquis, forthcoming.

R-2126-HEW, *The Methodology Used to Measure Health Care Consumption During the First Year of the Health Insurance Experiment*, K. H. Marquis, August 1977.

R-2141-1-HEW, *The Erosion of the Medical Marketplace*, J. P. Newhouse, December 1978.

R-2157-HEW, *Dental Care Demand: Point Estimates and Implications for National Health Insurance*, W. G. Manning and C. E. Phelps, forthcoming.

R-2167-HEW, *Copayments and Demand for Medical Care: The California Medicaid Experience*, L. J. Helms, J. P. Newhouse, and C. E. Phelps, forthcoming.

R-2173-HEW, *On the Theory and Practice of Obtaining Unbiased and Efficient Samples in Social Surveys and Experiments*, C. Morris, J. P. Newhouse, and R. W. Archibald, January 1980.

R-2262/2-HEW, *Conceptualization and Measurement of Physiologic Health for Adults in the Health Insurance Study: Acne*, R. H. Brook, K. N. Lohr, K. H. Applegate, G. A. Goldberg, and C. Kamberg, April 1979.

R-2262/3-HEW, *Conceptualization and Measurement of Physiologic Health for Adults in the Health Insurance Study: Hypertension*, K. H. Applegate, G. A. Goldberg, R. H. Brook, and K. N. Lohr, forthcoming.

R-2262/4-HEW, *Conceptualization and Measurement of Physiologic Health for Adults in the Health Insurance Study: Angina Pectoris*, M. Rosenthal, G. A. Goldberg, R. H. Brook, K. N. Lohr, and K. H. Applegate, forthcoming.

R-2262/5-HEW, *Conceptualization and Measurement of Physiologic Health for Adults in the Health Insurance Study: Congestive Heart Failure*, M. Rosenthal, R. H. Brook, K. N. Lohr, G. A. Goldberg, and K. H. Applegate, forthcoming.

R-2262/6-HEW, *Conceptualization and Measurement of Physiologic Health for Adults in the HIS: Anemia*, B. Scott, G. A. Goldberg, R. H. Brook, and K. N. Lohr, forthcoming.

R-2262/7-HEW, *Conceptualization and Measurement of Physiologic Health for Adults in the Health Insurance Study: Diabetes Mellitus*, K. H. Applegate, R. H. Brook, G. A. Goldberg, and K. N. Lohr, forthcoming.

R-2262/16-HEW, *Conceptualization and Measurement for Physiologic Health for Adults in the Health Insurance Study: Urinary Tract Infection*, J. Zielske, K. N. Lohr, and G. A. Goldberg, forthcoming.

R-2289-HEW, *The Norms Hypothesis and the Demand for Medical Care*, J. P. Newhouse and M. S. Marquis, June 1980.

R-2313-HEW, *Conceptualization and Measurement of Health for Children in the Health Insurance Study*, M. Eisen, C. A. Donald, J. E. Ware, Jr., and R. H. Brook, May 1980.

R-2319-HEW, *Record Check Validity of Survey Responses: A Reassessment of Bios in Reports of Hospitalizations*, K. H. Marquis, May 1978.

R-2374/1-HEW, *Conceptualization and Measurement of Health for Adults in the Health Insurance Study: Vol. I, Smoking*, A. L. Stewart, R. H. Brook, and R. L. Kane, June 1979.

R-2374/2-HEW, *Conceptualization and Measurement of Health Habits for Adults in the Health Insurance Study: Vol. II, Overweight*, A. L. Stewart, R. L. Brook, and R. L. Kane, forthcoming.

R-2431-HEW, *The Costs, Financing, and Distributional Effects of a Catastrophic Supplement to Medicare*, M. S. Marquis, August 1979.

R-2555-HEW, *Hospital Stay Response Error Estimates for the Health Insurance Study's Dayton Baseline Survey*, K. H. Marquis, May 1980.

R-2479-HEW, *Social Experimentation: Some Whys and Hows*, R. W. Archibald, and J. P. Newhouse, May 1980.

N-1183-HEW, *The Finite Selection Model: Description and User's Guide*, M. Seda and J. Kessey, June 1980.

N-1206-HEW, *Quality Assessment in Mental Health*, R. H. Brook, C. J. Kamberg, and K. N. Lohr, September 1979.

N-1212-HEW, *Evaluation of Health Diary Data in the Health Insurance Study*, K. H. Marquis, August 1979.

N-1346-HEW, *Nonresponse Issues in Public Policy Experiments, with Emphasis on the Health Insurance Study*, C. N. Morris, February 1980.

N-1473-HEW, *Do Payment Incentives Affect Response Time in a Social Experiment?*, C. D. Andre, May 1980.

HEALTH INSURANCE STUDY (nonexperimental)

Office of Economic Opportunity

Term and Scale of Effort: 7/71 – 7/72; 5 person years

Principal Investigator: Joseph P. Newhouse

Using nonexperimental data, Rand estimated the responsiveness of consumers to alternative health insurance plans and showed how that response differed by income group to provide guidance in designing a national health insurance plan.

R-976-OEO, *The Effects of Coinsurance on Demand for Physician Services*, C. E. Phelps and J. P. Newhouse, June 1972.

R-1096-NYC/OEO, *Population Health Survey 1968: Codebook and Marginals*, J. P. Acton, L. J. Clark, and R. J. Young, January 1973.

R-1108-OEO, *Optimal Insurance and Generalized Deductibles*, K. J. Arrow, February 1973.

R-1131-OEO, *Supply Responses of Young Physicians: An Analysis of Physicians in Residency Programs*, F. A. Sloan, March 1973.

R-1151-OEO/NYC, *Demand for Health Care among the Urban Poor, with Special Emphasis on the Role of Time*, J. P. Acton, April 1973.

R-1161-NYC/OEO, *Population Health Surveys for 1964, 1965, and 1966: Codebook and Marginals*, J. P. Acton, L. J. Clark, and R. J. Young, January 1973.

R-1162-NYC/OEO, *Population Health Survey for 1969-70: Codebook and Marginals*, J. P. Acton, L. J. Clark, and R. J. Young, January 1973.

R-1189-OEO/NYC, *Demand for Health Care When Time Prices Vary More than Money Prices*, J. P. Acton, May 1973.

DERIVATION OF EVIDENCE FROM THE 1970 CHARLESTON-NORC SURVEY TAPES ASSESSING THE EXTENT OF HEALTH INSURANCE COVERAGE IN THE UNITED STATES

Congressional Budget Office

Term and Scale of Effort: 7/76 – 8/76; .1 per years

Principal Investigator: Charles E. Phelps

Using the 1970 CHAS-NORC tapes and the 1974 and 1975 Department of Labor tapes, Rand assessed: (1) the number of persons covered and the internal limits of coverage for persons with employer group, other group, and non-group insurance, and (2) the rates of growth between 1970-1974 and 1974-1975 for specific parameters of the insurance policies, such as internal limits and maximum benefit features.

"Effects of Insurance on Demand for Medical Care," C. E. Phelps, in R. Andersen, J. Kravitz, and O. Anderson (eds.), *Equity in Health Services*, Ballinger, 1975.

DEMAND FOR HEALTH INSURANCE: AN EMPIRICAL STUDY

Health Services and Mental Health Administration

Term and Scale of Effort: 6/72 - 2/75; 4 person years

Principal Investigator: Charles E. Phelps

The health insurance market has several unusual features (e.g., both commercial and non-profit insurers competing with one another, group plans in which individual choice is highly limited, government both providing insurance and regulating other providers) which may affect how consumers select and use health insurance. Rand analyzed how insurance has been provided in the past and estimated demand curves for health insurance and for medical care, using observations of actual purchases in 1970, to improve predictions of the effects of any national health insurance proposal.

R-1054-OEO, *Demand for Health Insurance: A Theoretical and Empirical Investigation*, C. E. Phelps, July 1973.

DEMAND FOR MEDICAL CARE SERVICES

Health Services and Mental Health Administration

Term and Scale of Effort: 5/72 - 4/74; 4 person years

Principal Investigator: Joseph P. Newhouse

The demand for physician and hospital services depends on how much the consumer pays for those services. While it is recognized that the insured use medical services to a greater degree than the uninsured, few studies have tested whether those who buy health insurance have higher expectations (that are ultimately fulfilled) of becoming ill than those who do not buy insurance. Most studies assume that cost variations are attributable to the presence or absence of insurance on the basis that medical services are uniform across suppliers, but cost differences may in fact reflect differences in the quality of services. Rand sought to elucidate how the demand for medical services responds to varying features of health insurance plans, in preparation for the federal government designing a national health insurance program.

R-964-1-OEO/NC, *Coinsurance and the Demand for Medical Services*, C. E. Phelps and J. P. Newhouse, October 1974.

R-1514-OEO/NC, *Deductibles and the Demand for Medical Services: The Theory of the Consumer Facing a Variable Price Schedule under Uncertainty*, E. B. Keeler, J. P. Newhouse, and C. E. Phelps, December 1974.

R-1149-NC, *On Having Your Cake and Eating It Too: Econometric Problems in Estimating the Demand for Health Services*, J. P. Newhouse and C. E. Phelps, April 1974.

BIOSCIENCES

STATISTICAL PROCEDURES FOR TOXIC SUBSTANCES RESPONSE DATA

National Institutes of Health

Term and Scale of Effort: 6/79 - 6/80; .9 person years

Principal Investigator: John R. Van Ryzin

Estimating the environmental risks posed to man by toxic substances has become an increasingly important problem. As newer methods of detecting and assaying toxic substances (particularly carcinogenic agents) have appeared, the need has grown for improved methods of estimating the risks of low-level environmental exposures. This project developed such methods by generalizing various ways of estimating dose-response curves. The procedures being studied involved comparing a multi-hit model of toxic response with other existing models. Generalizations of this model to incorporate time-to-tumor and metabolic activity were also done.

N-1261-NIEHS, *Multihit: A Computer Program for Risk Assessment of Toxic Substances*, K. Rai, J. R. Van Ryzin, October 1979.

N-1512-NIEHS, *MULTI80: A Computer Program for Risk Assessment of Toxic Substances*, K. Rai and J. R. Van Ryzin, June 1980.

N-1513-NIEHS, *A Note on a Multivariate Version of Rolle's Theorem and Uniqueness of Maximum Likelihood Roots*, K. Rai, J. R. Van Ryzin, June 1980.

PREDICTIVE PHARMACOKINETIC MODEL OF ANTIFOLATE RESCUE

National Institutes of Health

Term and Scale of Effort: 7/76 - 7/79; 4 person years

Principal Investigator: Paul F. Morrison

Rand staff developed mathematical models of the distribution and metabolism of the anticancer drug methotrexate, and its antagonist citrovorum factor, based on laboratory data from patients undergoing treatment with the drug. Concentrations of methotrexate in target cancer tissues as well as sensitive normal tissues were computed from these models and related to measures of drug toxicity. Attainment of the ability to compute such drug levels allows physicians to discover schedules that maximize the effect of drugs against cancer cells while minimizing their effect on normal cells.

"Pharmacokinetics of High-Dose Methotrexate with Citrovorum Factor Rescue," W. H. Isacoff, P. F. Morrison, J. Aroesty, K. L. Willis, J. B. Block, and T. L. Lincoln, *Cancer Treatment Reports*, Vol. 61, No. 9, 1977.

"Decisionmaking in High-Dose Methotrexate Cancer Chemotheraphy," T. L. Lincoln, J. Aroesty, G. F. Groner, K. L. Willis, P. F. Morrison, and W. H. Isacoff, *Medical Informatics*, Vol. 2, No. 3, 1977.

"High-Dose Methotrexate in Citrovorum Rescue in the Chemotheraphy of Cancer: An Example of Clinical Data Analysis for Medical Decisionmaking," T. L. Lincoln, W. H. Isacoff, J. Aroesty, G. F. Groner, K. L. Willis, and P. F. Morrison, *Medical Computing*, Taylor and Francis, Ltd., London, England, 1977.

"Analysis of High-Dose Methotrexate Clinical Trial Data Using CLINFO," T. L. Lincoln, W. H. Isacoff, G. F. Groner, K. L. Willis, and P. F. Morrison, in A. S. Whittemore (ed.), *Environmental Health: Quantitative Methods*, SIAM, Philadelphia, 1976.

"New Mathematical Models of Cell Kinetics Including Heredity, Differentiation, and Regulatory Control," S. P. Creekmore, J. Johnson, J. Aroesty, T. L. Lincoln, and P. F. Morrison, *Proceedings of the Summer Computer Simulation Conference*, Chicago, July 18-20, 1977.

"A Cell Kinetic Model Which Includes Heredity, Differentiation, and Regulatory Control," S. P. Creekmore, J. Aroesty, K. L. Willis, P. F. Morrison, and T. L. Lincoln, in A. J. Valleron and P. D. M. Macdonald (eds.), *Biomathematics and Cell Kinetics*, Elsevier North Holland and Biomedical Press, 1978.

"An Analysis of Predictor Variables for Adjuvant Treatment of Breast Cancer," S. Kister, J. Aroesty, W. H. Rogers, C. Huber, K. L. Willis, P. F. Morrison, G. Shangold, and T. L. Lincoln, *Cancer Chemotherapy and Pharmacology, Vol. 2, No. 3, 1979.*

Abstract of "Mathematical Models of Methotrexate Resistance: Double Minute and Unequal Cross-over Models," *Cell and Tissue Kinetics*, 1980, forthcoming.

EPIDEMIOLOGY OF PEPTIC ULCERS (BIOLOGIC SPECIMENS)

University of California at Los Angeles

Term and Scale of Effort: 4/76 - 4/81; 2.1 person years

Principal Investigator: Marie E. Brown

In support of research on peptic ulcers, Rand provides all personnel, facilities and equipment required to obtain patient data and to obtain and to transfer to Los Angeles biologic specimens from participants of the Health Insurance Study who undergo physical examination. The data become a part of the HIS data base.

SOME IMPORTANT VISUAL ENVIRONMENTAL PROBLEMS OF THE PARTIALLY SIGHTED

Rehabilitation Services Administration and Santa Monica Hospital Medical Center

Term and Scale of Effort: 7/75 – 1/81; 5.3 person years

Principal Investigator: Samuel M. Genensky

In this project, Rand is examining how the partially sighted could use their residual vision more effectively. In cooperation with the Santa Monica Hospital Medical Center, project staff members are interviewing and testing partially sighted individuals to identify problems most frequently faced by the partially sighted in adapting to their environment. This research is designed to provide an understanding of how the more successful individuals overcome some of their visual environmental adaptation problems, and to enable the development of novel approaches that may help the partially sighted to cope with other environmental problems.

THE EPIDEMIOLOGY OF PEPTIC ULCERS: DECISIONMAKING FOR ULCER PATIENTS

University of California at Los Angeles

Term and Scale of Effort: 9/74 – 4/78; 1.7 person years

Principal Investigator: Mario L. Juncosa

Decision analysis models were formulated for two problems in the diagnosis and treatment of patients with gastric ulcer symptoms. The issues to be decided were (1) whether surgery or continued medication was to be preferred treatment for a seriousy bleeding duodenal ulcer, given the disutilities and associated probabilities of the consequences of each option; and (2) which of these gastroendoscopic options should be chosen (no endoscopy, immediate endoscopy, or endoscopy contingent on healing or non-healing by the time of the six-week checkups) in the case of gastric ulcer initially diagnosed by radiology as benign.

MATHEMATICAL MODELS FOR STUDYING SICKLE CELL DISEASE

National Institutes of Health

Term and Scale of Effort: 6/74 – 7/81; 8.6 person years

Principal Investigator: William S. King

In victims of sickle cell disease, the oxygen-carrying red blood cells become rigid and lose the ability to deform for easy passage through small capillaries, thus depriving the tissue of oxygen. The painful manifestation of this event

is called the "crisis." Currently, no clinically proven treatment can prevent the sickle cell crisis without posing the threat of other complications. During the first 18 months of this project, Rand staff developed a rationale for a screening methodology to be employed in the selection of possible therapeutic agents for reducing the incidence of sickle-cell crisis and alleviating the symptoms of the disease. Mathematical models showing the interplay among complex phenomena such as capillary flow, oxygenation, and red cell sickling were designed. Further research developed physiological models for blood chemistry, microcirculation fluid mechanics, red blood cell kinetics, and renal function. These models will be used in experimental design, therapeutic trials, assessment of toxicity effects, and treatment design and improvement, and in identifying the reasons for the considerable variation that exists among patients.

R-1974-HEW, *Therapeutic Implications of Physicochemical Phenomena Involved in Sickle-Cell Disease*, J. C. De Haven. April 1976.

R-1952-HEW, *Hematological Compensation During Treatment of Sickle-Cell Anemia: A Simple Mathematical Model*, J. Aroesty, T. L. Lincoln, W. S. King, and P. F. Morrison, December 1976.

"A Mathematical Model of the Effect of Oxygen Consumption on the Resistance to Flow of Sickle Cell Blood in Capillaries," D. O. Lomen and J. F. Gross, *Mathematical Biosciences*, Vol. 37, 1977.

"Iron-Deficiency Anemia and Sickle-Cell Disease: A Hypothesis," T. L. Lincoln, J. Aroesty, and P. F. Morrison, *The Lancet*, August 4, 1973.

"The Flow of Sickle-Cell Blood in the Capillaries," S. A. Berger and W. S. King, *Journal of Biophysics*, Vol. 29, 1980.

"An Analysis of Oxygen Transport in the Capillaries in Sickle-Cell Disease," S. A. Berger and W. S. King, *Proceedings of the Symposium on Biomechanics*, ASME, Summer meeting, Niagara Falls, New York, June 18-20, 1979.

"A Re-Examination of the Lighthill-Fitzgerald Theory," W. S. King, J. Aroesty, and J. Lamar, The Third International Congress of Biorheology, University of California at San Diego, 1978.

"The Interaction Between Oxygen Tension Levels and the Flow of Sickle Cell Blood in the Capillaries," W. S. King and S. A. Berger, The Third International Congress of Biorheology, University of California at San Diego, 1978.

"Diffusion and Transport in the Capillaries in Sickle Cell Disease," W. S. King and S. A. Berger, The Winter Annual Meeting of the American Society of Mechanical Engineers, San Francisco, California, 1978.

"A Simple Analysis of Hematological Compensation During Treatment of Sickle-Cell Anemia," J. Aroesty and W. S. King, XII International Conference on Medical and Biological Engineering, Jerusalem, Israel, August 1979.

"An Extended Theory of the Flow of Sickle Cell in a Capillary," S. A. Berger and W. S. King, *Proceedings of the 1980 Fall Meeting*, SIAM, Houston, Texas, November 1980.

DECISION-AIDING METHODOLOGY FOR LEUKEMIA CHEMOTHERAPY

National Institutes of Health

Term and Scale of Effort: 1/73 – 1/77; 7.4 person years

Principal Investigator: Jerome Aroesty

Rand staff collaborated with members of the Department of Developmental Therapeutics at M.D. Anderson Hospital in Houston, Texas, on the development of a computer-oriented decision-aiding system to assist in clinical research and patient management in the chemotherapeutic treatment of cancer. The immediate focus was on acute myelogenous leukemia.

R-1757-NIH, *The Disposition of Ara-C and Its Metabolites: A Pharmacokinetic Simulation*, P. F. Morrison, T. L. Lincoln, and J. Aroesty, August 1975; also in *Cancer Chemotherapy Reports*, Vol. 59, No. 4, Part 1, July/August 1975.

"Cell Kinetic Models of Transient States: A Preliminary Investigation of Lymphocyte Simulation," J. Aroesty et al., The Williams Wilkins Company, Baltimore, 1977.

COMPUTER SIMULATION OF THE BIOCHEMICAL SYSTEM

National Institutes of Health

Term and Scale of Effort: 6/72 – 9/75; 2.2 person years

Principal Investigator: Norman Z. Shapiro

In attempting to simulate the dynamic behavior of a system of interacting chemical substances, one of the principal practical difficulties is dealing with the occurrence of reactions that have widely differing rates. (The problem of disparate reaction rates arises sometimes in simulations of nonbiological systems, but it occurs very often and seriously in simulations of biological systems.) The differential equations arising from this problem tend to be "stiff", i.e., they require a large number of integration steps for their solution. This study explored a method for dealing with stiffness in chemical kinetic systems.

R-2356-RC, *A Scaling Theorems and Algorithms*, J. B. Bigelow and N. Z. Shapiro, July 1978.

R-2355-RC, *Stiff Differential Equations*, D. Garfinkel, C. B. Morbach, and N. Z. Shapiro, July 1978.

R-2357-RC, *A Method for Solving Certain Stiff Differential Equations*, R. Clasen, D. Garfinkel, G. Roman, and N. Z. Shapiro, July 1978.

"A Scaling Theorems and Algorithms," J. B. Bigelow and N. Z. Shapiro, *SIAM Journal on Applied Mathematics*, Vol. 33, No. 2, September 1977.

"Stiff Differential Equations," D. Garfinkel, C. B. Morbach, and N. Z. Shaprio, *Annual Reviews, Inc.*, Vol. 6, Palo Alto, 1977.

"A Method for Solving Certain Stiff Differential Equations," R. Clasen, D. Garfinkel, G. Romand, and N. Z. Shapiro, *SIAM Journal on Applied Mathematics*, Vol. 34, No. 4, June 1978.

INFORMATION TRANSFER PROBLEMS OF THE PARTIALLY SIGHTED

Social and Rehabilitation Service

Term and Scale of Effort: 5/71 – 7/75; 21 person years

Principal Investigator: Samuel M. Genensky

Rand designed, built, and tested electro-optical devices to aid the partially sighted. Closed-circuit television systems developed at Rand are capable of permitting a large fraction of the legally blind population, as well as others who have severe visual impairment, to read, write, and ultimately obtain schooling and employment.

R-831-HEW/RC, *An X-Y Platform for RANDSIGHT-Type Instruments*, R. W. Clewett, S. M. Genensky, and H. E. Petersen, August 1971.

R-1040-HEW/RC, *Advances in Closed Circuit TV Systems for the Partially Sighted*, S. M. Genensky, H. E. Petersen, H. L. Moshin, R. W. Clewett, and R. I. Yoshimura, April 1972.

R-1402-HEW, *Binoculars: A Long-Ignored Aid for the Partially Sighted*, S. M. Genensky, November 1973.

R-1537-HEW, *Interactive Classroom TV System for the Handicapped*, S. M. Genensky, H. F Petersen, R. I. Yoshimura, J. B. VonDerLieth, R. W. Clewett, and H. L. Moshin, June 1974.

R-1614-HEW, *A Double X-Y Platform for RANDSIGHT-Type Instruments*, S. M. Genensky, H. E. Petersen, R. W. Clewett, and H. L. Moshin, December 1974.

R-1770-HEW, *Information Transfer Problems of the Partially Sighted: Recent Results and Project Summary*, S. M. Genensky, H. E. Petersen, R. W. Clewett, and H. L. Moshin, June 1975.

CELL KINETICS COMPUTER MODEL FOR LEUKEMIA CHEMOTHERAPY

National Institutes of Health

Term and Scale of Effort: 4/71 - 6/80; 14.5 person years

Principal Investigator: Thomas L. Lincoln

The use of pharmacological agents in treating disease is limited by the lack of tools that can predict the effects of these drugs with confidence. Rand has spent several years developing a computer-operated mathematical model of patient response to cancer chemotherapy capable of predicting the probable response of the individual patient to a variety of possible treatments. Such a model would enable the physician to choose a drug dosage strategy that will increase the therapeutic margin favoring the destruction of tumor cells and minimize the effect of cytotoxic anticancer drugs on healthy cell systems.

R-1015-NIH, *VPACK: A FORTRAN-Callable Graphics Package for the Rand Video Graphic System*, R. L. Clark and G. F. Groner, December 1972.

R-2001-HEW, *The Computer Simulation of Leukemia Therapy: Combined Pharmacokinetics, Intracellular Enzyme Kinetics, and Cell Kinetics of the Treatment of L1210 Leukemia by ARA-C*, T. M. Lincoln, P. F. Morrison, J. Aroesty, and G. M. Carter, December 1976; also in *Cancer Treatment Reports*, Vol. 60, No. 12, December 1976.

"Immunologic Approach to Non-Hodgkin's Lymphomas and Related Leukemias Analysis of the Results of Multiparameter Studies of 425 Cases," T. L. Lincoln, *Seminars in Hematology*, Vol. 15, No. 4, October 1978.

"La Pharmacosimulation," T. L. Lincoln, *Pharmacologie Clinique*, Expansion Scientifique Francaise, Paris, France, 1978.

"New Mathematical Models of Cell Kinetics Including Heredity, Differentiation, and Regulatory Control," T. L. Lincoln et al., *Proceedings, Summer Computer Simulation Conference*, Chicago, July 18-20 1977.

"The Analysis of Functional Studies in Acute Lymphocytic Leukemia Using CLINFO--A Small Computer Information and Analysis System for Clinical Investigators," T. L. Lincoln et al., *Medical Informatics*, Vol. 1, No. 2, 1976.

"Computer Simulation in the Service of Chemotherapy," T. L. Lincoln et al., *European Journal Biomedicine*, Vol. 20, No. 1, 1974,

"Tumor Growth and Chemotheraphy: Mathematical Methods, Computer Simulations, and Experimental Foundations," T. L. Lincoln, J. Aroesty, N. Shaprio, and G. Boccias, *Mathematical Biosciences*, Vol. 17, 1973.

"Linear Estimation Theory for Predicting Platelet Counts in Leukemia Chemotheraphy," T. L. Lincoln and G. Meier, *Proceedings, 10th Symposium on Biomathematics and Computer in the Life Sciences*, Houston, Texas, March 1973.

FLUID MECHANICS OF THE MICROCIRCULATION

National Institutes of Health

Term and Scale of Effort: 1/71 – 1/75; 2.5 person years

Principal Investigator: Carl Gazley, Jr.

Using data and concepts from fluid mechanics, rheology, solid mechanics, mass transfer, tissue morphology, and ultrastructure, together with quantitative in vivo physiological data, Rand collaborated with staff at the University of California, San Diego, to construct a model of the mechanisms of the microcirculation. The model is designed for use in the preservation of organs, the design of artificial organs, and the clinical diagnosis of vascular diseases.

R-767-NIH, *Pulsatile Flow in Small Blood Vessels: I. Casson Theory*, J. Aroesty and J. F. Gross, April 1971.

R-768-NIH, *The Mathematics of Pulsatile Flow in Small Vessels: I, Casson Theory*, J. Aroesty, and J. F. Gross, April 1971.

R-769-NIH, *Rheological Properties of Biological Flow Systems*, C. Gazley, Jr., April 1971.

R-787-NIH, *Computer Techniques for Pseudocolor Image Enhancement*, J. V. Lamar, June 1971.

RM-6214-NIH, *Convection and Diffusion in the Microcirculation*, J. Aroesty and J. F. Gross, June 1970.

PROGRAM EVALUATIONS

APPROACHES TO CANCER PATIENT MANAGEMENT: A SYNOPSIS OF NETWORK PROGRAM EXPERIENCES

National Institutes of Health

Term and Scale of Effort: 10/79 – 4/81; 4.2 person years

Principal Investigators: Rosalie A. Kane and Robert L. Kane

In 1974, the National Cancer Institute set out to promote consistent, high-quality, comprehensive approaches to the breast and head-and-neck cancer problem by establishing a cooperative organization of hospitals or clinics—in essence, cancer networks. The networks were organized to enhance communication within a geographic area; permit a comprehensive approach to the cancer problem; foster multidisciplinary planning and problem solving; encourage linkages among formal organizations; systematically collect lon-

gitudinal information about a group of patients; and provide a possible decisionmaking framework for relevant individuals and groups.

The objective of Rand's research is to prepare a monograph (1) describing in detail the organizaion and work of the network, (2) analyzing the work of the networks for indications of how various patterns of organization and various network activities affect the community and facilitate achievement of network objectives, and (3) presenting the analysis in a form useful to those who plan to develop similar networks. The monograph will serve as a resource for any group attempting to coordinate educational, treatment, and research efforts on cancer and other health problems.

CASE STUDY OF END-STAGE RENAL DISEASE

Office of Technology Assessment

Term and Scale of Effort: 5/79 - 4/80; .1 person years

Principal Investigator: Richard A. Rettig

In conjunction with an Office of Technology Assessment (OTA) study of the Cost-Effectiveness of Medical Technologies, Rand staff analyzed two cost-benefit and cost-effectiveness studies of end-stage renal disease performed in 1966 and 1967. The contribution of these studies to policy formulation was identified and summarized, and implications of such studies for policy were discussed.

"Formal Analysis, Policy Formulation and End-Stage Renal Disease," R. A. Rettig, in *The Implications of Cost Effectiveness Analysis of Medical Technology*, Background Paper #2, Case Studies of Medical Technologies, Office of Technology Assessment, Congress of the United States, forthcoming.

EVOLUTION OF FEDERAL POLICY FOR CHRONIC RENAL DISEASE

National Center for Health Services Research

Term and Scale of Effort: 9/78 - 7/80; 1 person year

Principal Investigator: Richard A. Rettig

This project studied the evolution of federal government policy toward end-stage renal disease from the early 1960s through 1972. Development of this emerging policy included provision of treatment for veterans, support for biomedical research, demonstration of organizational feasibility of delivering care, development of treatment capacity, and enactment of patient-care financing as a near-universal entitlement. Key policymakers were interviewed and documents pertaining to major events were analyzed. This study

analyzed the emergence, validation and diffusion of major clinical innovation, especially medical technology, taking into account the dynamics of policy formulation and decisionmaking regarding the allocation of scarce medical resources.

R-2680-NCHSR, *The Evolution of Federal Policy for Chronic Renal Disease*, R. A. Rettig and E. L. Marks, forthcoming.

IMPLEMENTATION OF THE END-STAGE RENAL DISEASE PROGRAM

Health Care Financing Administration

Term and Scale of Effort: 10/77 - 7/79; 1.4 person years

Principal Investigator: Richard A. Rettig

It has become clear in the last decade that public policy, once formulated, is not automatically carried out. Recognition of this fact has led both policymakers and policy analysts to an increased interest in policy and program implementation, which has exposed gaps in our understanding of implementation. This research examined how the processes of implementation affect the relationship between initial policy choices and actual program outcomes.

This study analyzed the End-Stage Renal Disease Program (ESRD) establshed by the Social Security Amendments of 1972, and identified the major factors affecting its implementation. It also extracted the lessons from the ESRD implementation experience for potential use in the long-range ESRD program. Lessons learned from this study will be of use to national health insurance research.

R-2505-HCFA/HEW, *Implementing the End-Stage Renal Disease Program of Medicine*, R. A. Rettig, September 1980.

"The Politics of Health Cost Containment: End Stage Renal Disease," R. A. Rettig, *Bulletin of the New York Academy of Medicine*, Vol. 56, No. 1, January-February 1980.

EVALUATION OF A PREVENTIVE DENTAL CARE PROGRAM FOR SCHOOL-AGED CHILDREN

The Robert Wood Johnson Foundation

Term and Scale of Effort: 2/76 - 7/82; 35 person years

Principal Investigator: Stephen P. Klein

Three characteristics are unique to dental diseases: (1) they are almost universal, (2) they do not undergo remission or termination if untreated, but accumulate a backlog of unmet needs, and (3) they almost always require technically demanding, expensive, and time-consuming professional treat-

ment. In dentistry, unlike many other areas of medicine, preventive measures with children work, and such care may be substantially less expensive than corrective treatment. The Robert Wood Johnson Foundation is supporting a large-scale investigation, conducted by the American Fund for Dental Health, of the cost-effectiveness of a comprehensive school-based dental health program. The study aims to provide local decision-makers with the information needed to determine which kind of multifaceted program, if any, would be most cost-effective for their community. Rand developed the study's basic research design and specifications for data collection and analysis, and is responsible for the evaluation and analysis of the experiment.

R-2536/1-RWJ, *The First Year of Field Activities in the National Preventive Denistry Demonstration Program*, S. P. Klein, H. Bohanan, P. E. Anderson, J. A. Disney, and F. H. Leone, July 1979.

R-2536/2-RWJ, *The First Year of Field Activities in the National Preventive Denistry Demonstration Program: Appendixes*, S. P. Klein, H. Bohanan, P. E. Anderson, J. A. Disney, and F. H. Leone, July 1979.

THE IMPACT OF EMERGENCY MEDICAL SYSTEM REGIONALIZATION

The Robert Wood Johnson Foundation

Term and Scale of Effort: 7/73 – 9/78; 10 person years

Principal Investigators: Robert J. Gladstone and Jan Chaiken

Many emergency medical rescue systems are considered inadequate in their technology, organization, and medical competence. The Robert Wood Johnson Foundation, in an attempt to promote the coordination of emergency medical services providers, decided to award two-year grants of up to $400,000 to each of 44 regions of the United States. The grants were to be used to centralize emergency medical communications, to train dispatchers and ambulance personnel, and to cover related expenses. Rand assessed the effects of the resulting regionalization of service provision on the emergency medical care systems by analyzing data collected in selected regions.

R-1551-RWJF, *Some Trends in the Delivery of Ambulance Services*, J. M. Chaiken and R. J. Gladstone, July 1974.

R-2381-RWJF, *Impacts of Efforts to Regionalize Emergency Medical Services*, R. W. Archibald, J. M. Chaiken, P. D. Fleischauer, D. Lieberson, R. L. Rasmussen, and W. E. Walker, forthcoming.

EVALUATION OF THE SOCIAL IMPACT OF NATIONAL HEART AND LUNG INSTITUTE PROGRAMS

National Institutes of Health

Term and Scale of Effort: 5/73 – 4/75; 1.2 person years

Principal Investigator: Jan P. Acton

In this study, Rand staff developed a quantitative approach to evaluation and estimated the willingness of individuals to pay additional taxes to improve treatment for heart, circulatory, and lung diseases. The study was designed to assist the National Heart and Lung Institute in allocating resources for medical research and in determining more accurately the results of the programs it funds.

R-1697-NHLI, *Measuring the Social Impact of Heart and Circulatory Disease Programs: Preliminary Framework and Estimates*, J. P. Acton, April 1975.

QUALITY OF CARE

MEDICAL TECHNOLOGY INFORMATION NEEDS OF PHYSICIANS AND PSROS AND THE POTENTIAL ROLES OF PSROS IN MEETING THOSE NEEDS

Office of Technology Assessment

Term and Scale of Effort: 9/80 – 4/81; .5 person years

Principal Investigators: Kathleen N. Lohr and Robert H. Brook

Relatively little information exists about (1) how individual practicing physicians learn of new technologies (with the possible exception of drugs), or of the obsolescence of current practices; (2) the decision process by which they incorporate technologies into their practices; and (3) what information (or modes of information dissemination) convinces physicians to drop outmoded technologies with which they are comfortable. The role of Professional Standards Review Organizations (PSROs)—as synthesizers, disseminators, and collectors or coordinators—in dealing with appropriate use of technology is only poorly understood.

Staff will review the relevant literature to determine what is known about how physicians acquire information on medical technologies and incorporate this new knowledge into their practices, and will examine how PSROs perceive their role in this process. Information will be solicited from PSRO officials, officials of federal agencies with which PSROs may have links, and with other persons involved in technology information dissemination and PSROs.

THE IMPACT OF THE NEW MEXICO EXPERIMENTAL MEDICAL CARE REVIEW ORGANIZATION ON THE COST AND QUALITY OF MEDICAL CARE: A FOUR-YEAR EVALUATION

Department of Health, Education, and Welfare (Assistant Secretary for Planning and Evaluation)

Term and Scale of Effort: 7/76 - 4/78; 2 person years

Principal Investigator: Robert H. Brook

Health professionals, consumers, and public officials have experienced growing concern about the dual issues of the rising costs and the less than optimal quality of medical care. One approach to deal with these two areas of concern has been developed within the public sector in the form of the Professional Standards Review Organization (PSRO). PSROs seek cost containment and quality improvement through administrative and peer review of medical claims. The New Mexico Experimental Medical Care Review Organization (EMCRO), established more than five years ago, is considered one of the more successful predecessors to PSRO. Rand carried out an earlier evaluation of the New Mexico EMCRO, after its first two years of operation, examining the impact of the EMCRO on the cost and (principally) the quality of medical care for the Medicaid population. In this study, Rand extended the original analysis to the first four years of EMCRO's operation in order to evaluate the further impact of EMCRO on the cost and quality of care, so that the anticipated benefits of PSRO could be more clearly defined. As the federal government becomes more involved in establishing minimum standards of physician performance, the findings should be relevant to a number of government programs, legislative initiatives, and administrative guidelines.

R-2241-HEW, *Controlling the Use and Cost of Medical Services: The New Mexico Experimental Medical Care Review Organization—A Four-Year Case Study*, R. H. Brook, K. N. Williams, J. E. Rolph, and B. M. Mori, November 1978.

R-2513-HEW, *Quality of Care in the New Mexico Medicaid Program (1971-1975). The Effect of the New Mexico Experimental Medical Care Review Organization on the Use of Antibiotics for Common Infectious Diseases*, K. N. Lohr, R. H. Brook, and M. A. Kaufman, April 1980.

"Effect of Medical Care Review on the Use of Injections. A Study of the New Mexico Experimental Medical Care Review Organization," R. H. Brook and K. N. Williams, *Annals of Internal Medicine*, Vol. 85, 1976.

"Quality of Care in the New Mexico Medicaid Program (1971-1975): The Effect of the New Mexico Experimental Medical Care Review Organization on the Use of Antibiotics for Common Infectious Disease," K. N. Lohr, R. H. Brook, and M. A. Kaufman, *Medical Care*, Vol. 18, No. 1, January 1980.

MEASURING THE EFFECT OF THE HEALTH CARE DELIVERY SYSTEM ON HEALTH STATUS

Health Resources Administration

Term and Scale of Effort: 7/76 - 9/77; 3 person years

Principal Investigators: David E. Drew and L. Jefferson Harris

Local health agencies are directed by Congress to engage systematically and regularly in comprehensive health resources planning. A major component of this planning involves obtaining and analyzing data on the health status of local residents. The intent of this project was to provide the technical assistance necessary to enable local health personnel to use the health status data obtained. A major product of the research was a technical manual that facilitates the retrieval, analysis, and application of data for use in allocating health resources. The study also assessed the degree to which the manual contributes to decisionmaking in health agencies.

R-2215/1-HEW, *Algorithm for Health Planners: An Overview*, L. J. Harris, August 1977.

R-2215/2-HEW, *Algorithm for Health Planners: Infant Mortality*, L. J. Harris and E. B. Keeler, August 1977.

R-2215/3-HEW, *Algorithm for Health Planners: Breast Cancer Mortality*, A. Kisch and E. B. Keeler, August 1977.

R-2215/4-HEW, *Algorithm for Health Planners: Heart Attack*, L. J. Harris, E. B. Keeler, S. Cretin, and M. E. Michnich, August 1977.

R-2215/5-HEW, *Algorithm for Health Planners: Preventable Death and Disease*, A. I. Kisch and S. F. DeSola, August 1977.

R-2215/6-HEW, *Algorithm for Health Planners: Hypertension*, D. E. Drew and E. B. Keeler, August 1977.

FORMULATION OF PROXIMATE OUTCOME MEASURES OF HEALTH CARE

Health Resources Administration

Term and Scale of Effort: 7/75 - 10/76; 3.7 person years

Principal Investigator: Robert H. Brook

The medical care industry is expected to consume approximately $115 billion in the next fiscal year, a figure likely to be over 8 percent of the GNP. Yet even with this massive expenditure of funds on the medical care system in the United States, critics complain that effective procedures are not being delivered equitably to all people. On the one hand there is a clamor for increased expenditure of funds on effective procedures; on the other, a demand for the use of existing medical care resources in a more efficient manner. Resolution of these issues will depend on the development of valid proximate

outcome variables—measures that correlate in a known manner with the final outcome of care for given conditions, problems, or diagnoses. This study sought solutions to the conceptual and technical problems associated with formulating such valid proximate outcomes to measure the quality of health care delivery.

R-2021/1-HEW, *Quality of Medical Care Assessment Using Outcome Measures: An Overview of the Method*, R. H. Brook, A. D. Avery, S. Greenfield, L. J. Harris, T. Lelah, N. E. Solomon, and J. E. Ware, Jr, August 1976.

R-2021/2-HEW, *Quality of Medical Care Assessment Using Outcome Measures: Eight Disease-Specific Applications*, A. D. Avery, T. Lelah, N. E. Solomon, L. J. Harris, R. H. Brook, S. Greenfield J. E. Ware, Jr., and C. H. Avery, August 1976.

R-2021/3-HEW, *Quality of Medical Care Assessment Using Outcome Measures: Executive Summary*, R. H. Brook, and A. D. Avery, August 1976.

EVALUATING THE IMPACT OF THE NEW MEXICO EMCRO ON AMBULATORY CARE

Health Care Management Systems

Term and Scale of Effort: 7/75 – 8/75; .1 person years

Principal Investigator: Robert H. Brook

Rand reviewed the performance of the New Mexico EMCRO after its first two years of operation, studying its impact on the cost and quality of ambulatory care for the Medicaid population. Peer review (review on medical rather than administrative grounds) of claims for the following services was studied: injections, laboratory tests, prescription drugs, and utilization of ambulatory visits.

R-2110-HEW/RC, *Evaluation of the New Mexico Peer Review System, 1971-1973*, R. H. Brook and K. N. Williams, February 1977.

CARE OF THE ELDERLY

PROGNOSING THE COURSE OF NURSING HOME PATIENTS

National Center for Health Services Research

Term and Scale of Effort: 9/79 – 2/82; 9.4 person years

Principal Investigator: Robert L. Kane

Despite their deficiencies, nursing homes are a major means of caring for the aged and chronically ill. They have the capacity and the desire to accept responsibility for care that cannot be provided by either family or hospital. There is a crisis in nursing home care, however, and a better way to manage this segment of the health care industry must be found. If nursing home care is to remain in the private sector, control must come through policies that accept and are based upon free enterprise. A review of the problems with current regulatory and reimbursement schemes requires studying regulation, payment, and quality of care. This project is a first step in developing a means by which payment for nursing home services can be tied to patient outcomes.

This project will develop and test a reliable means of developing prognoses for nursing home patients. These prognoses will be cast in a form that will permit quantitative comparison with the actual outcome of patient care. An interdisciplinary team (physician, nurse, and social worker) will gather physiologic, psychologic, social, and other data every three months on some 500 patients thought to be receiving good nursing home care. These data will be used to predict each patient's medical future based on the team's best clinical judgment. The actual outcomes will then be compared with the predicted outcomes. A mathematical model of prediction will be developed, based on both team and expert judgments, and a refined scale of outcomes will be formulated.

A COMPREHENSIVE COMMUNITY CARE SYSTEM FOR PARTIALLY SIGHTED OLDER PERSONS

Santa Monica Hospital Medical Center

Term and Scale of Effort: 1/79 – 1/81; 2.1 person years

Principal Investigator: Samuel M. Genensky

Partially sighted persons are those whose visual field does not exceed 20 degrees in any direction; or whose visual acuity does not exceed 20/70 with ordinary corrective lenses, but is better than mere light perception or light projection. Persons 65 and older account for 48 percent of the partially sighted, yet little research has been done on their functional vision problems, and few services exist to meet their needs. Rand staff working with the SMHMC

Center for the Partially Sighted will collect information on vision problems of several hundred older adults. The data will be used to establish a service delivery system that will offer these adults an alternative to blindness, provide them with an option to institutionalization, and enable them to carry out a full range of activities, including some with a large visual component.

DEMONSTRATION AND ASSESSMENT OF PSRO LONG-TERM CARE REVIEW

Health Care Financing Administration

Term and Scale of Effort: 10/78 – 8/79; 3 person years

Principal Investigator: Robert L. Kane

The Social Security Amendments of 1972 set up Professional Standards Review Organizations (PSROs) — groups of physicians tasked with monitoring the quality of the services provided by the Medicaid, Medicare, and Maternal and Child Health Programs. The plan also envisioned a PSRO review of long-term care. In 1976, 14 PSROs were funded to conduct demonstration projects to develop, implement, and assess the utility and cost of various methods of long-term care (LTC) review. Rand evaluated the effectiveness of ten of these demonstration projects in terms of (1) the achievement of each PSRO within the framework of its unique objectives and setting, and (2) the collective contribution of PSROs to the body of knowledge about LTC review. Rand's findings aided in formulating, developing, and implementing future long-term care review systems.

R-2459/1-HCFA, *The PSRO and the Nursing Home: Vol. 1, An Assessment of PSRO Long Term Care Review*, R. A. Kane, R. L. Kane, D. Kleffel, R. H. Brook, C. Eby, G. A. Goldberg, L. Rubenstein, and J. R. Van Ryzin, August 1979.

R-2459/2-HCFA, *The PSRO and the Nursing Home: Vol. 2, Ten Demonstration Projects in PSRO Long-Term Care Review*, R. A. Kane, R. L. Kane, D. Kleffel, R. H. Brook, C. Eby, and G. A. Goldberg, August 1979.

"Utilization Review in Nursing Homes: Making Implicit Level-of-Care Judgments Explicit, R. L. Kane, L. Z. Rubenstein, R. H. Brook, J. R. Van Ryzin, P. Masthay, E. Schoenrich, and B. Harrell, *Medical Care*, forthcoming.

GERIATRIC POLICY ANALYSIS WORKGROUP

The Henry J. Kaiser Family Foundation and Rand-Sponsored Research

Term and Scale of Effort: 10/78 – 4/80; 2.5 person years

Principal Investigator: Robert L. Kane

Health care for the elderly, a growing segment of society with a disproportionate number of medical problems, is currently neglected. This research has yielded a definition of the elderly population, an assessment of their problems, and an evaluation of available treatments. Staff analyzed the allocation of funds spent on the elderly, and qualified physician effort involved in their care. The results include a state-of-the-art paper defining the physician manpower required for adequate elderly care and steps needed to achieve these levels.

R-2543-HJK, *Geriatrics in the United States: Manpower Projections and Training Considerations*, R. L. Kane, D. H. Solomon, J. C. Beck, E. B. Keeler, and R. A. Kane, May 1980.

"The Future Need for Geriatric Manpower in the United States," R. L. Kane, D. H. Solomon, J. C. Beck, E. B. Keeler, and R. A. Kane, *New England Journal of Medicine*, Vol. 302, 1980.

"Role of Health Services Research in Geriatric Education," R. L. Kane, in K. Steel (ed.), *Textbook on Geriatric Education*, D. C. Heath and Company, forthcoming.

MEDICAL EDUCATION AND RESEARCH POLICY

ROLES FOR POLICY ANALYSIS IN BIOMEDICAL RESEARCH

National Institutes of Health

Term and Scale of Effort: 11/75 – 3/76; .5 person year

Principal Investigator: Albert P. Williams

In early 1976, the President's Biomedical Research Panel was formed to assess the size and content of the federal biomedical research program. Few serious attempts to determine the feasibility of—much less to perform—useful policy analysis in the biomedical research area have been made. To assist the Panel in its work, Rand staff produced an essay on the prospects for policy research, examining the state of the art of analysis that is or could become relevant to decisionmaking, and described an agenda of analysis that could improve policy decisions in the future.

R-1945-PBRP/RC, *Policy Analysis for Federal Biomedical Research*, A. P. Williams, G. M. Carter, A. J. Harman, E. B. Keeler, W. G. Manning, C. R. Neu, M. L. Pearce, and R. A. Rettig, March 1976.

THE IMPACT OF FEDERAL HEALTH-RELATED EXPENDITURES UPON UNIVERSITIES AND ACADEMIC MEDICAL CENTERS

American Council on Education

Term and Scale of Effort: 7/75 – 4/76; 6.6 person years

Principal Investigator: Albert P. Williams

Rand, the American Council on Education, and the Association of American Medical Colleges collaborated on a full examination of the relationship between federal funding for the life and biomedical sciences and educational programs and research. Within the larger analysis, the research tasks conducted by Rand concerned the impact of funding on two types of institutions: academic medical centers and university departments. The study addressed such issues as the effects of research grants on educational programs and on faculty hiring and compensation policy; the interaction between patient care activity, research activity and educational programs; the influence of funding on the specialty choice of medical students; and the effect of changes in funding by NIH on revenue from other sources.

R-1943-PBRP, *The Effect of Federal Biomedical Research Programs on Academic Medical Centers*, A. P. Williams, G. M. Carter, D. S. Chu, S. B. Coleman, A. P. Massell, C. R. Neu, R. L. Rasmussen, and W. H. Rogers, March 1976.

R-1944-PBRP, *The Effects of Federal Funds upon Selected Health-Related Disciplines*, D. E. Drew, J. G. Wirt, F. W. Finnegan, M. C. Fujisaki, and A. L. Laniear, March 1976.

MEDICAL SCHOOL ADMISSIONS AND THE EFFECT OF AFFIRMATIVE ACTION PROGRAMS

Health Resources Administration

Term and Scale of Effort: 6/75 – 12/76; 2 person years

Principal Investigator: Albert P. Williams

The process of selecting students for admission to medical school absorbs considerable resources. The concern of faculty and administrators with the admissions process is based in part on the presumption that the character of the incoming class affects the quality of physicians graduated. Earlier Rand work focused on discrimination against women and the importance of pro-

grams for minority applicants. The goals of this project were to extend the previous analysis of programs for disadvantaged applicants and determine whether differences between disadvantaged applicants and the rest of the applicant pool, both in entering qualifications and in academic performance, are diminishing. The research was also concerned with the importance of state of residence in admissions policy.

R-2014-HEW, *The Effect of State of Residence on Medical School Admissions*, A. P. Williams and J. E. Rolph, February 1978.

R-2029-HEW, *A Comparison of Minority and Non-Minority Medical Student Performance on the National Board Exams*, A. P. Williams, L. Laniear, W. D. Cooper, and J. E. Rolph, November 1978.

R-2030-HEW, *Factors Affecting Medical School Admission Decisions for Minority and Non-Minority Applicants: A Comparative Study of Ten Schools*, A. P. Williams, W. D. Cooper, and C. L. Lee, December 1979.

THE COST OF CARE IN TEACHING AND NON-TEACHING HOSPITALS

Health Resources Administration

Term and Scale of Effort: 6/75 – 7/76; 1.7 person years

Principal Investigator: Albert P. Williams

One or more teaching hospitals are major elements of every academic health center. These hospitals serve the special function of training future physicians as well as the normal function of providing medical care to patients. Consequently, the payments for medical services obtained in teaching hospitals cover the joint production of teaching and medical care. Since the federal and state governments make many of these payments through various medical insurance programs, they are concerned that the cost of training in teaching hospitals not add excessive financial burdens to health care insurance programs. Rand staff estimated the effects of medical education programs on the total costs (hospital-billed and separately billed professional costs) of in-patient care billed on a fee-for-service basis.

R-2027-HEW, *Comparing Costs of Inpatient Care in Teaching and Nonteaching Hospitals: A Feasibility Study*, A. P. Williams and A. P. Massell, June 1977.

R-2204-HEW, *The Cost of Inpatient Care in Teaching and Non-Teaching Hospitals: An Analysis of Episodes for Medicaid Patients*, C. R. Neu, forthcoming.

ANALYSIS OF NATIONAL INSTITUTES OF HEALTH POLICIES FOR THE SUPPORT OF EXTRAMURAL RESEARCH

National Institutes of Health

Term and Scale of Effort: 4/75 – 1/78; 9.5 person years

Principal Investigator: Grace M. Carter

The scope and complexity of the influence of federal programs on academic health centers have generated considerable concern both in the federal government and in the academic community. One can readily identify a dozen different federal agencies administering more than 100 distinct programs directly involving academic health centers. In addition, the federal government has become increasingly involved in regulatory activity affecting the centers. The National Institutes of Health are the major sources of support for the biomedical research performed in academic health centers in the country. The analysis of NIH policy undertaken in this project had three tasks: (1) to describe the nature of research produced under grants from NIH, and to examine the effect of alternative NIH policies on the output of these grants, (2) to examine the consequences of decisions by NIH not to fund proposed research, and (3) to analyze the effect of federal programs on the supply and demand of medical faculty.

R-2228-1-NIH, *A Comparison of Large Grants and Research Project Grants Awarded by the National Institutes of Health*, G. M. Carter, C. S. Lai, and C. L. Lee, October 1978.

R-2229-NIH, *The Consequences of Unfunded NIH Applications for the Investigation and HIS Research*, G. M. Carter, W. D. Cooper, C. S. Lai, and D. M. S. March, October 1978.

FEDERAL PROGRAMS AND MEDICAL SCHOOL OPERATIONS: AN EVALUATION

National Institutes of Health

Term and Scale of Effort: 3/72 – 11/75; 20 person years

Principal Investigator: Albert P. Williams

Federal support for medical education runs to roughly $1 billion annually. Because the three basic "products" of medical schools (education, patient care, research) are hard to measure, it is difficult to determine whether those funds are being spent effectively. Rand investigated the internal workings of medical schools, the considerable differences among them, and means of measuring their performance so that federal support programs could be evaluated more effectively. Research begun under this project has been continued in several projects, funded by HEW.

R-1464-HEW, *Federal Manpower Legislation and the Academic Health Centers: An Interim Report*, G. M. Carter, D. S. Chu, J. E. Koehler, R. L. Slighton, and A. P. Williams, April 1974.

R-1583-HEW, *Peer Review, Citations, and Biomedical Research Policy: NIH Grants to Medical School Faculty*, G. M. Carter, December 1974.

R-1723-HEW, *Medical School and Physician Performance: Predicting Scores on the American Board of Internal Medicine Written Examination*, R. M. Bell, August 1977.

R-1814/1-HEW, *The Federal Government and Academic Medicine: Executive Summary*, A. P. Williams, G. M. Carter, D. S. Chu, and J. Koehler, forthcoming.

R-1814-HEW, *The Federal Government and Academic Medicine: The Effects of Federal Programs on Activities and Outputs*, A. P. Williams, G. M. Carter, D. S. Chu, and J. Koehler, forthcoming.

HEALTH MANPOWER AND PROVIDER BEHAVIOR

THE MIGRATION OF PHYSICIANS INTO NONMETROPOLITAN AREAS

The Henry J. Kaiser Family Foundation

Term and Scale of Effort: 2/80 – 4/81; .4 person years

Principal Investigator: Albert P. Williams

This planning grant will be used to analyze and expand existing data bases, with the aim of developing methods that will yield policy-relevant information on physician manpower issues. Staff will make more accurate ratios of specialists (and physicians) to population than have been available to date, to determine whether rural physicians see more patients than their urban colleagues. This project lays the groundwork for longer-term analyses of location choices of all physicians.

LOCATION OF PHYSICIAN SPECIALISTS IN RURAL AREAS

National Center for Health Services Research

Term and Scale of Effort: 9/79 – 1/81; .7 person years

Principal Investigator: Albert P. Williams

The public debate over physician supply in rural areas leaves an overwhelming impression that it is inadequate and getting worse over time. Evidence is emerging, however, which suggests that access to care is much less disparate between urban and rural areas than is commonly assumed.

The objectives of this project were (a) to examine the fashion in which board-certified physicians in a representative group of specialists have distributed themselves in non-urban areas over the period 1960 to 1977, and (b) to determine the way in which the access distance to board-certified specialists in non-urban areas has been affected by changing patterns of distribution. The research findings and estimates of demand enable us to make crude predictions about how new specialists will distribute themselves during the next five to ten years.

R-2673-HHS/RC, *The Changing Distribution of Board Certified Physicians*, W. B. Schwartz, J. T. Newhouse, B. W. Bennett, and A. P. Williams, October 1980; also in *New England Journal of Medicine*, October 1980.

ANALYSIS OF THE CLINICAL LABORATORY INDUSTRY

Health Care Financing Administration

Term and Scale of Effort: 10/78 - 8/82; 2.7 person years

Principal Investigator: Patricia Munch Danzon

Concern has been voiced over rapidly rising expenditures on clinical laboratory tests, particularly since technological advance has actually reduced the unit cost of many tests. This study attempts to estimate the effect of economic factors on the price of laboratory tests, on the frequency with which tests are ordered, and on the physician's decision to perform tests in-house rather than an independent laboratory. Variables of particular interest are the reimbursement practices of third-party payors, state regulation of the independent clinical laboratory industry, whether the prescribing physician is reimbursed on a salary or a fee-for-service basis. The study utilizes data from an HEW survey of office-based physician practices and the Rand Health Insurance Study. A second part of the study is a theoretical and empirical analysis of the effect of Medicare reimbursement policies on hospital costs and charges.

R-2525-HCFA, *Economic Factors in the Use of Laboratory Tests by Office-Based Physicians*, F. P. Munch, April 1980.

R-2582-HCFA, *Profits in Hospital Laboratories: The Effects of Reimbursement Policies on Hospital Costs and Charges*, P. Munch Danzon, September 1980.

"Economic Incentives to Order Lab Tests: Theory and Evidence," F. P. Munch, *Socioeconomic Issues of Health*, June 1980.

COST/QUALITY TRADE-OFF

Congressional Budget Office

Term and Scale of Effort: 11/76 - 12/80; .3 person years

Principal Investigator: Albert P. Williams

This project considered the issues surrounding regulatory activity designed to assure the efficacy of medical treatment. The present regulatory structure does not deal with the efficacy of treatment, but rather with the inputs to treatment (such as drugs and medical devices). It also fails to take account of the inherent risks in all treatment and the differing attitudes of patients toward death, disability, and pain.

N-1598-CBO/RC, *Government Regulation and Medical Efficiency*, A. P. Williams and E. B. Keeler, forthcoming.

AN ECONOMIC ANALYSIS OF MEDICAL MALPRACTICE

Health Care Financing Administration

Term and Scale of Effort: 9/76 - 8/80; 2 person years

Principal Investigator: Patricia Munch Danzon

Over the past two decades, there has been rapid growth in the frequency and size of malpractice claims, and in malpractice insurance premiums, with substantial variation across states. A number of reforms affecting the medical, legal, and insurance sectors have been enacted, and more fundamental charges have been proposed. Rand made theoretical and empirical analyses of the disposition of malpractice claims, of determinants of the fequeny of claims and level of premiums, and of contingent fees for legal services. This study should contribute to a better understanding of the causes of the alleged defects of the current system. Rand's analysis, which extends across states and over time, examines variations in the determination of awards, claims frequency, and premium levels.

R-2340-NIH/RC, *Doctors, Damages and Deterrence: An Economic View of Medical Malpractice*, W. B. Schwartz and N. K. Komesar, June 1978.

R-2458-HCFA, *Contingent Fees for Personal Injury Litigation*, P. Munch Danzon, June 1980.

R-2623-HCFA, *Why are Malpractice Premiums So High—or So Low?*, P. Munch Danzon, June 1980.

R-2622-HCFA/ICJ, *The Disposition of Medical Malpractice Claims*, P. Munch Danzon, June 1980.

N-1535-HCFA, *Determinants of the Frequency of Malpractice Claims*, P. Munch Danzon, forthcoming.

PROFESSIONAL LIABILITY: ISSUES AND OPTIONS

California Citizens' Commission on Tort Law Reform

Term and Scale of Effort: 8/76 – 8/77; 1.2 person years

Principal Investigators: F. Patricia Munch and Dennis E. Smallwood

Rand prepared a series of papers for the California Commission on Tort Law Reform examining several issues related to liability, under tort law, of such professionals as physicians, lawyers, and accountants. Specific questions addressed include the evolution and current status of legal doctrine and insurance institutions, alternative institutions for controlling quality of professional services and compensating victims of negligence, the case for regulation of the insurance industry, and the effects of various modifications of existing tort law.

Professional Liability, F. P. Munch and D. E. Smallwood, Los Angeles California Citizens' Commission on Tort Reform, 1979.

P-5921, *Costs and Benefits of the Tort System if Viewed as a Compensation System*, F. P. Munch, June 1977.

POLITICAL, LEGAL, AND ORGANIZATIONAL INFLUENCES ON THE DEVELOPMENT OF THE CALIFORNIA HEALTH FACILITIES COMMISSION

Social Security Administration

Term and Scale of Effort: 7/76 – 12/77; 1.2 person years

Principal Investigator: Albert J. Lipson

Concern about increased health care costs prompted various states to establish health facility public disclosure and rate regulatory bodies. The California Hospital Commission (later renamed the California Health Facilities Commission) was set up in response to such concerns in 1972, with responsibility to develop a uniform budgetary and accounting system for California hospitals. The purpose of this project was to document the history and performance of the Commission, emphasizing the political, legal, and organizational factors that influenced its development. Knowledge of the processes affecting the course of the California commission should enable other states and the federal government to consider alternative ways to cope with rising institutional health care costs.

R-2220-HCFA, *The California Health Facilities' Commission: A Case Study of Government Regulation*, A. J. Lipson, November 1977.

R-2220/1-HCFA, *The California Health Facilities Commission: A Case Study of Government Regulation: Executive Summary*, A. J. Lipson, November 1977.

MEDICAL MALPRACTICE ISSUES

State of California (Postsecondary Education Commission)

Term and Scale of Effort: 12/75 – 7/76; .3 person year

Principal Investigator: Albert J. Lipson

Rand staff studied the response of California physicians to major increases in medical malpractice insurance premiums. The study specifically reviewed effects on physician supply, fees, insurance coverage, and practice patterns. It also examined the willingness of physicians to serve Medi-Cal patients, and the effects on availability and quality of care. Rand's study was part of a larger effort by the California Postsecondary Education Commission to analyze California health manpower issues.

R-2026-PSEC, *Medical Malpractice: The Response of Physicians to Premium Increases in California*, A. J. Lipson, November 1976.

RURAL PHYSICIAN SUPPLY

Health Resources Administration

Term and Scale of Effort: 6/75 – 5/76; .5 person years

Principal Investigator: Sinclair B. Coleman

The apparent maldistribution of physicians is now emerging as a major concern to politicians developing new health manpower legislation. There appears to be growing Congressional interest in more active governmental intervention to change the pattern of physician location in order to meet the needs of underserved, rural areas. Research in this area analyzed the current geographical pattern of physician location, the individual physician's location decision process, and possible government policies that would affect the supply of physicians in rural areas.

R-1887-HEW, *Physician Distribution and Rural Access to Medical Services*, S. B. Coleman, April 1976.

R-1887/1-HEW, *Physician Distribution and Rural Access to Medical Services: Executive Summary*, S. B. Coleman, April 1976.

CALIFORNIA HEALTH MANPOWER

State of California (Department of Health)

Term and Scale of Effort: 8/73 – 4/74; .5 person years

Principal Investigator: Albert J. Lipson

In this project, Rand identified and analyzed health manpower trends and policy issues of concern to California policymakers. The study examined such

issues as the supply and distribution of physicians and nurses, medical education, and health manpower licensure and planning.

R-1481-CHD, *Medical Manpower Models: Needs, Demand, and Supply*, J. R. Lave, L. B. Lave, and S. Leinhardt, March 1974.

R-1572-CHD, *California Health Manpower: An Overview of Trends and Policy Issues*, A. J. Lipson, March 1974.

HOSPITAL PRODUCTIVITY AND COSTLINESS

National Institutes of Health

Term and Scale of Effort: 6/73 – 12/75; 3 person years

Principal Investigator: Richard V. Cooper

The rapidly rising cost of hospital care has prompted interest in regulating hospital pricing and developing appropriate cost reimbursement schemes, but little is actually known about how hospital productivity and costliness are determined. In this project, Rand undertook three tasks: (1) development of a methodology for estimating cost functions in hospital departments, using data from Veterans Administration hospitals, (2) development of a cost methodology for hospitals as a whole, using data from the American Health Association, and (3) development of a cost methodology for determining the costs of emergency care, using data from a local hospital.

R-1751-HEW, *Estimating the Effects of Teaching on the Costs of Inpatient Care: The Case of Radiology Treatments*, A. P. Massell and J. R. Hosek, August 1975.

ATTRACTING PHYSICIANS TO RURAL AREAS

Department of Health, Education, and Welfare (Assistant Secretary for Planning and Evaluation)

Term and Scale of Effort: 7/71 – 2/74; 3 person years

Principal Investigator: James K. Cooper

The physician/population ratio and the number of medical school graduates in the U.S. have both increased since 1950, but the additional physicians have not been evenly distributed. Urban areas have been the main beneficiaries of the increase, while rural areas have experienced a disproportionate decline. Rand sought to identify the factors that attract physicians to or discourage them from small town practice, and to determine the professional, social, economic, political, and ecological attributes a small community needs in order to retain a physician or medical unit.

R-1477-HEW, *Choice of Location of Practice of Medical School Graduates: Analysis of Two Surveys*, K. A. Heald, J. K. Cooper, and S. B. Coleman, November 1974.

PATIENT EDUCATION, COMPLIANCE, AND HEALTH STATUS

THE QUALITY AND EFFECTIVENES OF PREVENTIVE MEDICAL CARE

Health Care Financing Administration

Term and Scale of Effort: 10/80 – 10/83; 7 person years

Principal Investigators: Lee Lillard and Charles E. Phelps

Preventive medicine can be broadly characterized as medical interventions that take place without apparent disease. It differs from acute medicine in that the choice to obtain preventive medical care is made in advance of known symptons of illness.

Discussions of national health insurance hold that the incentives are designed for acute care rather than preventive care. The alleged consequences of curative care are higher long-run costs for achieving a given level of health than would otherwise be the case, and possibly a reduction in potentially achievable improved health through more extended use of preventive care.

This study will assess the contribution of additional preventive medical care to improvements in health, to reductions in acute medical expenses, and to increased work and leisure time for the consumer.

Although major policy decisions regarding preventive medicine may be made before the Rand work is concluded, the study results should nevertheless be of considerable value, because major federal programs, the needs of the population, and the priorities of decisionmakers tend to change. New insights into preventive medicine should enhance future public decisions, even if only to modify past positions.

CONSUMER UNDERSTANDING OF THE MEDICAL CARE DELIVERY SYSTEM

Health Care Financing Administration

Term and Scale of Effort: 10/78 – 1/81; 2.5 person years

Principal Investigator: Joseph P. Newhouse

The assumption that increased consumer knowledge of the medical care delivery system could contribute to more effective use of the system is fre-

quently questioned on the grounds that medical care is too complex for consumers to understand. Although insurance constitutes a major component of the system, little study has been made of how well consumers understand their various policies. Using data from the ongoing Health Insurance Study, staff measured consumers' understanding of their policies and variations in the extent of knowledge among individuals. In addition, the study assessed consumers' comparative understanding of the simpler insurance plans (including health maintenance organization benefits) and the more complex plans, measured consumer sophistication about and belief in the efficacy of the medical care delivery system, and explained variations in such sophistication and beliefs across individuals.

"How Sophisticated Are Consumers about the Medical Care Delivery System?," J. P. Newhouse, J. E. Ware, Jr., and C. A. Donald, *Medical Care*, forthcoming.

EFFECTS OF PATIENT PACKAGE INSERTS (PPI) AS A FUNCTION OF CRITICAL VARIATIONS

Food and Drug Administration

Term and Scale of Effort: 10/78 – 4/81; 7.6 person years

Principal Investigator: David E. Kanouse

The Food and Drug Administration (FDA), which is responsible for labeling prescription drugs, has found it desirable to increase the use of informational literature accompanying prescription medicine (Patient Package Inserts - PPIs). To determine the most effective design of PPIs to communicate drug information, Rand analyzed the use of various types of inserts through a series of experimental studies conducted with the cooperation of selected local pharmacies. Patients filling prescriptions for each of three drugs were enlisted as experimental subjects. The research results will help guide policy regarding the design of FDA-regulated documents.

N-1552-FDA, *Design of the Prescription Drug Information Study*, D. E. Kanouse, S. Berry, B. Hayes-Roth, and W. H. Rogers, forthcoming.

EVALUATING THE ROLE OF THE MEDIA IN PUBLIC HEALTH BEHAVIOR

Office of Science and Technology Policy

Term and Scale of Effort: 7/78 – 11/78; .1 person year

Principal Investigator: Robert L. Kane

Rand staff reviewed the literature on evaluation of the effect of the media, particularly television, on public health behavior. Based on this review, Rand

proposed a set of approaches to evaluation for a particular health education topic, e.g., weight control.

"Channeling Health: A Review of the Evaluation of Televised Health Campaigns," R. Lau, R. L. Kane, J. E. Ware, Jr., S. Berry, and D. Roy, *Health Education Quarterly*, 1980.

MEASURES OF BEHAVIOR, ATTITUDES, AND KNOWLEDGE REGARDING DIABETIC PATIENT EDUCATION, WITH EMPHASIS ON NUTRITION

Center for Disease Control

Term and Scale of Effort: 10/77 - 7/79; 2.4 person years

Principal Investigator: Kent H. Marquis

Successful management of chronic disease, such as diabetes, often depends on how well a patient cares for himself. Self-care is a low-cost component of management, and the resulting good health can have important benefits both for society and the patient. But patients vary in how conscientiously they care for themselves, and tests of theories to explain this variation produce equivocal results. Are the theories wrong, or have we failed to measure the theoretical variables correctly?

In the course of the project, Rand staff agreed about the identity of the most important self-care variables for diabetics but found few valid measures of the variables. New measures were tested and their strengths and weaknesses identified. Results showed that patient conscientiousness is not unidimensional; new compliance theories are needed to account for this complexity.

R-2480-HEW, *Measures of Diabetic Patient Knowledge, Attitudes, and Behavior Regarding Self-Care: Summary Report*, K. H. Marquis and J. E. Ware, Jr., June 1979.

N-1151-HEW, *Appendix A to Summary Report: Variables Judged Important in Compliance with Diabetes Treatment Regimens*, K. H. Marquis, J. E. Ware, Jr., A. Davies-Avery, and M. E. Michnich, June 1979.

N-1152-HEW, *Appendix B to Summary Report: An Evaluation of Published Measures of Diabetes Self-Care Variables*, K. H. Marquis, J. E. Ware, Jr., R. H. Johnston, Jr., M. S. Marquis, M. E. Michnich, B. J. Rose, J. A. Stein, and C. T. Veit, June 1979.

N-1153-HEW, *Appendix C to Summary Report: New Measures of Diabetic Patient Behavior, Knowledge, and Attitudes*, K. H. Marquis, J. E. Ware, Jr., and D. A. Relles, June 1979.

PSYCHOMETRIC EVALUATION OF HEALTH SURVEY DATA

University of California at Los Angeles

Term and Scale of Effort: 3/77 - 7/77; .3 person years

Principal Investigator: John E. Ware, Jr.

Rand performed secondary analyses of health survey data to study differences in the quality of the data when variables are measured by one questionnaire item as opposed to multiple-item scales. Data quality was defined in terms of score variability, reliability, and validity. The project staff studied items and scales to measure general health perceptions, attitude toward doctors, and attitudes towards access to care.

INFORMATION PROCESSING

EVALUATION OF THE ROLE OF CLINICAL RESEARCH CENTERS IN CLINICAL TRIALS, WITH EMPHASIS ON INFORMATION PROCESSING

National Institutes of Health

Term and Scale of Effort: 9/78 - 12/80; 6.1 person years

Principal Investigator: Marsha D. Hopwood

Clinical trials attempt to assess the diagnostic, therapeutic, or preventive effect and value of medical agents, devices, regimens or procedures in human subjects prior to widespread application. Their importance lies in providing a testing ground for potentially effective medical therapies that may improve health care and help to control health care costs. Trials, however, can be expensive and lengthy with results that are difficult to interpret because of inadequate information-processing resources or insufficient collaboration among clinical trial centers. Rand developed a characterization of clinical trials and an evaluation of how current and potential information-processing resources, including computer-based information systems, can improve trials at clinical research centers. The results will be used by the NIH General Clinical Research Centers Program in deciding about specific resources to develop and support.

R-2653-NIH, *A First-Order Characterization of Clinical Trials*, M. D. Hopwood, J. C. Mabry, and W. L. Sibley, forthcoming.

R-2669-NIH, *The Role of General Clinical Research Centers in Clinical Trials: A Characterization with Recommendations*, M. D. Hopwood, J. C. Mabry, and W. L. Sibley, forthcoming.

CLINFO: AN INVESTIGATION INTO THE INFORMATION PROCESSING NEEDS OF CLINICAL RESEARCHERS

National Institutes of Health

Term and Scale of Effort: 6/72 - 4/79; 18.5 person years

Principal Investigators: Gabriel F. Groner and William L. Sibley

CLINFO was a scientific inquiry aimed at identifying, characterizing, and developing means to facilitate intellectual tasks and information flows in clinical investigation—i.e., medical research involving experiments with human subjects. The study demonstrated that facilities for data organization, storage, retrieval, reduction, and analysis in clinical investigation were inadequate and that no existing computer systems were suitable for introduction into General Clinical Research Centers. Rand worked with National Institutes of Health staff and clinical investigators at Baylor University, the University of Oklahoma, and the University of Washington to design and implement a prototype computer system prototype computer system that was introduced into three research centers for further investigation and validation. As a result of the CLINFO experience, NIH decided to install a commercially produced version of the prototype system in their General Clinical Research Centers as funding permits.

R-1539-NIH, *A Survey of Clinical Investigators and Their Information Processing Activities*, N. A. Palley and G. F. Groner, July 1974.

R-1540-NIH, *A Structural Characterization of Clinical Research Participants and Their Activities*, G. F. Groner, N. A. Palley, and N. Z. Shapiro, January 1975.

R-1541-NIH, *An Introduction to the CLINFO Prototype Data Management and Analysis System*, G. F. Groner, M. D. Hopwood, N. A. Palley, and W. L. Sibley, December 1977.

R-1542-NIH, *A Plan for the Development and Evaluation of a Data Management and Analysis System for Clinical Investigators*, G. F. Groner, M. D. Hopwood, N. A. Palley, N. Z. Shapiro, and W. L. Sibley, August 1974.

R-1543-1-NIH, *CLINFO User's Guide: Release One*, N. A. Palley, G. F. Groner, W. L. Sibley, and M. D. Hopwood, April 1976.

R-1543-2-NIH, *CLINFO User's Guide: Release Two*, N. A. Palley, G. F. Groner, M. D. Hopwood, and W. L. Sibley, October 1976.

R-1543-3-NIH, *CLINFO User's Guide: Release Three* G. F. Groner, N. A. Palley, M. D. Hopwood, W. L. Sibley, and B. Fishman, September 1977.

R-1621-NIH, *A Prototype Data Management and Analysis System for Clinical Investigators: An Initial Functional Description*, W. L. Sibley, M. D. Hopwood, G. F. Groner, and N. A. Palley, August 1974.

R-2260-NIH, *An Evaluation of the CLINFO Data Management and Analysis System*, M. D. Hopwood, G. F. Groner, N. A. Palley, W. L. Sibley, H. K. Thompson, J. C. Mabry, T. G. Christopher, R. O. Ling, W. W. Lary, and J. L. O'Connor, November 1977.

SUBSTANCE ABUSE

TESTING AN INPUT-OUTPUT MODEL FOR THE NATIONAL INSTITUTE ON ALCOHOL ABUSE AND ALCOHOLISM TREATMENT PROGRAMS

National Institute on Alcohol Abuse and Alcoholism

Term and Scale of Effort: 11/73 - 12/80; 12 person years

Principal Investigators: David J. Armor and Harriet B. Braiker

Under the Comprehensive Alcohol Abuse and Alcoholism Act of 1970, the National Institute on Alcohol Abuse and Alcoholism (NIAAA) initiated funding for a series of alcoholism treatment centers located throughout the United States. During the first two years of this project, Rand used data collected at the centers to show the relative importance of client characteristics versus center characteristics in changing drinking behavior. The study tested whether the services offered were in fact adequate to rehabilitate alcoholics or whether rehabilitation depended more on the characteristics of the client served. In its third year, "input-output" models for predicting the effectiveness of alcoholism treatment programs were developed. Characteristics of clients as well as types of treatment are known as "input"; "output" refers to various criteria such as alcohol consumption or behavioral impairment by which client improvement or recovery from alcoholism can be judged. The data obtained from NIAAA treatment centers broadened our knowledge in several ways, including, for example, the finding of relatively uniform effects of treatment across a dozen treatment modes for a large national sample of alcoholics. Later research extended these preliminary findings to a national, representative sample of alcoholic treatment centers, and provided the first look at the characteristics of a cross-section of alcoholics in public and private treatment centers.

R-1739-NIAAA, *Alcoholism and Treatment*, D. J. Armor, J. M. Polich, and H. B. Stambul, June 1976.

Alcoholism and Treatment, D. J. Armor, J. M. Polich, and H. B. Stambul, John Wiley & Sons, 1978.

A FOUR-YEAR FOLLOWUP STUDY OF ALCOHOLISM TREATMENT CENTER CLIENTS

National Institute on Alcohol Abuse and Alcoholism

Term and Scale of Effort: 5/76 - 2/80; 4 person years

Principal Investigator: J. Michael Polich

This research provides the alcoholism treatment and research community with the first broadly based, national study of the course of alcoholism after

treatment. Analysis is based on four-year longitudinal data from a cohort of 922 former patients of alcoholism treatment centers supported by the National Institute on Alcohol Abuse and Alcoholism. Outcomes four years after treatment are described through interview data, psychological and psychiatric assessments, and officially recorded mortality statistics. Substudies assess the validity of interview results, using corroborating data and measures of blood alcohol content.

The project seeks to improve our basic understanding of the long-term dynamics of alcoholism, focusing on the nature of remission and its stability over time. Analysis isolates characteristics of patients and treatments that foreshadow both favorable and unfavorable outcomes, examining broad patterns of social, psychological, and economic adjustment as well as drinking behavior. Departing from the traditional model of a single, permanent disorder, the research portrays alcoholism as a chronic relapsing phenomenon including several subtypes with different forms of remission.

R-2433-NIAAA, *The Course of Alcoholism: Four Years After Treatment*, J. M. Polich, D. J. Armor, and H. B. Braiker, January 1980.

"Patterns of Alcoholism over Four Years," J. M. Polich, D. J. Armor, and H. B. Braiker, *Journal of Studies on Alcohol*, Vol. 41, No. 5, May 1980.

"The Rand Reports and the Analysis of Relapse," D. J. Armor, in G. Edwards and M. Grant (eds.), *Alcoholism Treatment in Transition*, Croom Helm, London, 1980.

"Patterns of Remission in Alcoholism," J. M. Polich, in G. Edwards and M. Grant (eds.), *Alcoholism Treatment in Transition*, London, Croom Helm, 1980.

The Course of Alcoholism: Four Years After Treatment, J. M. Polich, D. J. Armor, and H. B. Braiker, John Wiley and Sons, forthcoming 1981.

P-6538, *The Validity of Self-Reports in Alcoholism Research*, J. M. Polich, November 1980.

P-6441, *Patterns of Alcoholism Over Four Years. Text of a Presentation to the National Advisory Council on Alcohol Abuse and Alcoholism, Washington, D.C.*, J. M. Polich and H. B. Braiker, January 1980.

P-6441-1, *Patterns of Alcoholism Over Four Years*, J. M. Polich, D. J. Armor, and H. B. Braiker, January 1980.

ADULT DRINKING PATTERNS AND ATTITUDES TOWARD DRINKING

National Institute on Alcohol Abuse and Alcoholism

Term and Scale of Effort: 7/76 – 12/77; 1 person year

Principal Investigator: Harriet B. Braiker

Since its creation in 1970, the National Institute on Alcohol Abuse and Alcoholism has sought to expand knowledge of the dangers associated with the excessive use of alcohol. To determine whether, and how, public awareness, attitudes, and behavior regarding alcohol have changed during the past few years, Rand staff used existing data from national surveys to describe the patterns of drinking and attitudes toward alcohol in the United States between 1972 and 1976. The research included the documentation of trends within subpopulations whose uses of alcohol are known to differ, such as groupings according to age, sex, and socio-economic status.

HOUSING STUDIES

G. Thomas Kingsley, Program Director

The Housing Studies Program includes research on how housing markets work, the nature and causes of national housing problems, and the effectiveness of government programs addressed to those problems.

The core of the program is the Housing Assistance Supply Experiment (HASE), conducted by Rand since 1972 under contract to the U.S. Department of Housing and Urban Development. HASE was designed to test the market effects of cash allowances paid to low-income families to help them with their housing expenses. Ten-year allowance programs were mounted in two metropolitan housing markets, and their effects were monitored for several years thereafter. The experimental data are now under analysis, with a final report due late in 1981.

The data collected for this experiment offer rich opportunities for research and policy analysis. Over 25,000 households enrolled in the program during the first five years, and all transactions with each household have been recorded and organized chronologically. In each site, a market-wide probability sample of 2,000 residential properties was monitored for four years, yielding time series on property characteristics and condition, occupancy status, characteristics of owners and occupants, and comprehensive financial accounts covering the ownership and operation of each property.

In conjunction with other data (such as the Annual Housing Survey conducted nationally by the Bureau of Census), the HASE files are now being used to address topics ranging beyond the original mission of the Supply Experiment: the estimation of housing service production functions, dimensions and determinants of housing demand, a general theory of housing market dynamics, housing search behavior, the determinants of housing repair and improvement decisions, the dynamics of participation in transfer programs, and the techniques and costs of program administration.

Charles E. Nelson was Director of the Housing Studies Program from 1972 to 1979. G. Thomas Kingsley became Director of the Program in October 1979.

HOUSING MARKET BEHAVIOR

Department of Housing and Urban Development

Term and Scale of Effort: 7/79 – 8/81; 14.2 person years

Principal Investigators: Bryan Ellickson, C. Peter Rydell, and Kevin F. McCarthy

The data files developed at Rand for the Housing Assistance Supply Experiment form the base for these studies of housing market dynamics. Demand behavior is being studied with a model that assigns household groups to housing units of various types. Supply behavior models are based on the functional relations between resource inputs such as land, capital improvements, and services and the output of housing services. A review of existing housing market models has helped isolate the policy-relevant aspects of short run housing market behavior.

The research will contribute to the knowledge of how households behave in the housing market, how supply and demand are equilibrated in submarkets, and the trade-offs among land, labor, and capital in the production of housing services.

This research also examines the degree to which the transaction costs of moving affect moving behavior. Transaction costs being investigated include moving expenses, search costs, and the impact of discrimination.

WELFARE REFORM AND HOUSING ASSISTANCE PROGRAMS

Department of Housing and Urban Development

Term and Scale of Effort: 10/77 – 2/79; .9 person years

Principal Investigator: Rodney T. Smith

How should the reform of welfare programs (especially the cashing out of food stamps) mesh with existing housing assistance programs? This project examined two alternatives. Either the cash assistance can be reduced by some portion of the housing assistance, or the increased cash assistance can reduce the amount of the housing assistance. The first alternative means that less cash assistance would be given to participants than to nonparticipants in housing programs. The second means that households with housing assistance would receive less support after the food stamp program is replaced by increased cash assistance.

The project reviewed existing benefit schedules, with emphasis on interactions between programs; surveyed estimates of the amount of cash that would induce recipients to leave in-kind programs; presented a general theory and methodology for estimating how multiple in-kind assistance programs affect household consumption patterns and real income; applied the methodology in evaluating in-kind assistance received by low-income families in New York, Michigan, Indiana, and Wisconsin; and analyzed how various formulations for

cashing out food stamps, cash assistance, and housing assistance affect the housing consumption of poor households, their incentives to participate in housing programs, and their real income.

R-2333-HUD, *Welfare Reform and Housing Assistance*, R. T. Smith, September 1979.

SOCIAL ASPECTS OF FEDERAL LOW-INCOME HOUSING PROGRAMS

Department of Housing and Urban Development

Term and Scale of Effort: 4/73 - 10/73; 1.3 person years

Principal Investigator: Stephen M. Barro

Rand assisted the Housing Policy and Review Task Force in a comprehensive review of federal housing policy which sought reasons for the failure of multi-family housing projects, a detailing of the costs of producing subsidized housing as opposed to conventional housing, and the determination of who benefits from federal housing programs and who does not. Rand staff developed and evaluated intergovernmental grant (special revenue sharing) alternatives to existing low-income housing programs. The resulting report focused on the following issues: (1) the division of housing responsibilities among federal, state, and local governments, (2) alternative formulas for distributing housing grants among jurisdictions, (3) federal standards and controls in a revenue sharing context, and (4) the direct federal role in housing under a decentralized system. (In June 1974, HUD abandoned public housing programs and instituted a comprehensive program of rent supplements for low-income groups.)

THE HOUSING ASSISTANCE SUPPLY EXPERIMENT

Department of Housing and Urban Development

Term and Scale of Effort: 4/72 - 10/81; 597 person years

Principal Investigator: Ira S. Lowry

The Housing Assistance Supply Experiment is one among several elements of the Experimental Housing Allowance Program undertaken by the Office of Policy Development and Research, U.S. Department of Housing and Urban Development. The program is designed to help HUD decide whether a program of direct cash assistance to low-income households is a feasible and desirable way to help them secure decent housing in a suitable living environment; and if so, to help determine the best terms and conditions for such assistance and the most efficient and appropriate methods for administering a full-scale program. As part of the experimental allowance program, the

Supply Experiment addresses issues of market and community response to housing allowances. It entails operating for 10 years a full-scale allowance program in each of two metropolitan areas, chosen for strong contrasts in their housing markets; and monitoring program operations and market responses for about five years. The communities selected for the experiment were Brown County, Wisconsin (whose central city is Green Bay), and St. Joseph County, Indiana (South Bend). The allowance program is open to all families and most single persons unable to afford the standard cost of adequate housing on the local market without spending more than a fourth of their adjusted gross incomes. Each enrolled household receives monthly cash payments equal to the difference between a fourth of its adjusted gross income and the cost of adequate housing, provided that the housing unit it occupies meets minimum standards of decency, safety, and sanitation.

The program is funded by a ten-year annual contributions contract between HUD and a local housing authority at each site. That authority in turn delegates program operations to a nonprofit corporation established by Rand at each site, the Housing Allowance Office. The Housing Allowance Office enrolls eligible applicants, evaluates their housing, and disburses payments.

The experimental allowance program is designed to simulate a permanent full-scale program in its effects on the local housing market and the community. These effects are monitored principally through an annual cycle of field surveys addressed to a marketwide sample of residential properties, once before the program begins and for up to five years thereafter. The data gathered from these surveys and from other research are directed primarily at several clusters of issues bearing on the merits and optimal design of a housing allowance program: supply responsiveness; behavior of market intermediaries and indirect suppliers; residential mobility and neighborhood change; community attitudes and effects on nonparticipants; and administrative procedures.

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R-1959-HUD, *Second Annual Report of the Housing Assistance Supply Experiment*, HASE Staff, May 1976.

R-1959/1-HUD, *Second Annual Report of the Housing Assistance Supply Experiment: Executive Summary*, HASE Staff, May 1976.

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R-2151/1-HUD, *Third Annual Report of the Housing Assistance Supply Experiment: Executive Summary*, HASE Staff, February 1977.

R-2302-HUD, *Fourth Annual Report of the Housing Assistance Supply Experiment*, HASE Staff, May 1978.

R-2302/1-HUD, *Fourth Annual Report of the Housing Assistance Supply Experiment: Executive Summary*, HASE Staff, March 1978.

R-2434-HUD, *Fifth Annual Report of the Housing Assistance Supply Experiment*, HASE Staff, June 1979.

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N-1215-HUD, *A Topical Guide to HASE Research*, I. S. Lowry, June 1979.

N-1089-HUD, *Market Intermediaries and Indirect Suppliers: Reconnaissance and Research Design for Site 2*, W. Grigsby, M. G. Shanley, and S. B. White, July 1980.

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N-1044-HUD, *Additional Estimates of Enrollment and Allowance Payments Under a National Housing Allowance Program*, T. Repnau and B. M. Woodfill, July 1980.

N-1042-HUD, *Data Management Systems for the Housing Assistance Supply Experiment*, C. M. Dodd, M. C. Fujisaki, and G. Levitt, July 1980.

N-1041-HUD, *Collected Site Selection Documents: Housing Assistance Supply Experiment*, T. Corcoran, E. C. Poggio, and T. Repnau, July 1980.

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N-1033-HUD, *Site Selection for the Housing Assistance Supply Experiment: SMSA's Preposed for Site Visits (A Briefing)*, HASE staff, July 1980.

N-1029-HUD, *Data Management System: Part 1, Fieldwork Data and Data Transfer Specifications*, G. Levitt, July 1980.

N-1028-HUD, *Preliminary Description of Survey Instruments*, HASE staff, July 1980.

N-1027-HUD, *Preliminary Design for the Housing Assistance Supply Experiment*, I. S. Lowry, July 1980.

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R-2475-HUD, *Landlord Knowledge and Evaluation of Housing Allowances: St. Joseph County, Indiana, 1975*, D. E. Kanouse, May 1980.

R-2453-HUD, *Shortrun Response of Housing Markets to Demand Shifts*, C. P. Rydell, September 1979.

R-2452-HUD, *How Housing Allowances Affect Housing Prices*, C. L. Barnett and I. S. Lowry, September 1979.

R-2451-HUD, *Housing Search and Mobility*, K. F. McCarthy, September 1979.

R-2450-HUD, *Using Hedonic Indexes to Measure Housing Quantity*, C. L. Barnett, October 1979.

R-2449-HUD, *Income Elasticity of Housing Demand*, J. E. Mulford. July 1979.

R-2259-HUD, *Public Perceptions of Housing Allowances: The First Two Years*, P. L. Ellickson and D. E. Kanouse, September 1979.

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N-1091-HUD, *Housing Choices and Residential Mobility in Site I at Baseline*, K. F. McCarthy, October 1979.

N-1101-HUD, *Market Intermediaries and Indirect Suppliers: First Year Report for Site I*, S. B. White, November 1979.

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N-1135-HUD, *Vacancy Duration and Housing Market Condition*, C. P. Rydell, October 1979.

N-1144-HUD, *Residential Mobility of Housing Allowance Recipients*, M. D. Menchik, October 1979.

N-1145-HUD, *Controlling Errors in Allowance Program Administration*, P. Tebbets, August 1979.

N-1192-HUD, *Estimated Effects of Increased Income on Homeowner Repair Expenditures*, L. Helbers, November 1979.

N-1198-HUD, *Housing Allowances and Housing Improvement: Early Findings*, J. L. McDowell, September 1979.

N-1205-HUD, *Neighborhoods in St. Joseph County, Indiana*, J. E. Bala, September 1979.

N-1208-HUD, *How Low-Income Renters Buy Homes*, M. Shanley and C. Hotchkiss, August 1979.

N-1276-HUD, *Analyzing Allowance Program Administrative Costs: Accounting Structures and Methodology*, G. T. Kingsley, P. M. Schlegel, December 1979.

N-1277-HUD, *Allowance Program Administration: Interim Findings*, G. T. Kingsley, December 1979.

N-1305-HUD, *Assessing Hedonic Indexes for Housing*, C. W. Noland, May 1980.

N-1306-HUD, *Effects of the HAO Lead-Based Paint Hazard Standard*, J. L. McDowell, June 1980.

N-1456-HUD, *How Allowance Recipients Adjust Housing Consumption*, J. E. Mulford, G. Weiner, and J. L. McDowell, August 1980.

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N-1081-HUD, *Audit of the Baseline Landlord Survey in Site I*, R. Stanton and T. Britt, October 1979.

N-1097-HUD, *Audit of the Baseline Household Survey in Site I*, L. Helbers, October 1979.

N-1108-HUD, *Audit of the Baseline Survey of Tenants and Homeowners in Site II*, J. E. Mulford, forthcoming.

N-1113-HUD, *Audit of the Baseline Neighborhood Survey of Site II*, J. E. Bala, October 1979.

N-1115-HUD, *Audit of the Baseline Neighborhood Survey in Site I*, C. L. Barnett, October 1979.

N-1120-HUD, *Audit of the Baseline Survey of Residential Buildings in Site II*, L. A. Day and C. W. Noland, October 1979.

N-1121-HUD, *Audit of the Baseline Landlord Survey in Site II*, R. Stanton, R. Britt, forthcoming.

N-1142-HUD, *Codebook for the Attitude Module of the Survey of Landlords, Site II, Wave 2*, P. M. Boren and R. Johnston, May 1980.

N-1146-HUD, *Codebook for the HAO Client Characteristics File: Site I, Year 3*, A. W. Wang and L. E. Geller, May 1979.

N-1147-HUD, *Codebook for the HAO Housing Characteristics File: Site I, Year 3*, A. W. Wang and L. E. Geller, May 1979.

N-1148-HUD. Codebook for the HAO Housing Characteristics File: Site I, Year 3, A. W. Wang and L. E. Geller, May 1979.

N-1149-HUD, *Audit of the HAO Analysis Files, Site I, Year 3*, A. W. Wang, May 1979.

N-1173-HUD, *Audit of the Household Attitude Survey, Site II, Wave 2*, M. Baran, July 1979.

N-1189-HUD, *Codebook for the Survey of Landlords, Site I, Wave 2*, P. M. Boren, June 1979.

N-1190-HUD, *Codebook for the Household Survey, Site I, Wave 2*, P. M. Boren, July 1979.

N-1191-HUD, *Codebook for the Survey of Residential Buildings, Site I, Wave 2*, P. M. Boren, August 1979.

N-1270-HUD, *Codebook for the HAO Client Characteristics File: Site II, Year 3*, A. W. Wang and L. E. Geller, forthcoming.

N-1271-HUD, *Codebook for the HAO Housing Characteristics File: Site II, Year 3*, A. W. Wang and L. E. Geller, October 1979.

N-1272-HUD, *Codebook for the HAO Recertification Characteristics File: Site II, Year 3*, A. W. Wang and L. E. Geller, October 1979.

N-1282-HUD, *Audit of the Neighborhood Survey, Site I, Wave 4*, C. E. Hillestad, November 1979.

N-1298-HUD, *The Relevance to HUD of Recent Scholarly Research in Urban Economics*, S. J. Carroll, A. H. Pascal, and M. N. Caggiano, forthcoming.

N-1379-HUD, *Supplemental Codebook for the Household Survey, Site II, Wave 3*, R. M. Allen and E. C. Casper, July 1980.

N-1387-HUD, *Supplemental Codebook for the Survey of Landlords, Site II, Wave 3*, P. M. Boren and K. C. Wong, July 1980.

N-1309-HUD, *Codebook for the Household Survey, Site I, Wave 3*, P. M. Boren, November 1979.

N-1318-HUD, *Audit of the HAO Analysis Files, Site II, Year 3*, A. W. Wang, October 1979.

N-1345-HUD, *Codebook for the Attitude Module of the Household Survey, Site I, Wave 3*, P. M. Boren, January 1980.

N-1349-HUD, *Codebook for the Survey of Landlords, Site I, Wave 3*, P. M. Boren. January 1980.

N-1351-HUD, *Codebook for the Survey of Landlords, Site I, Wave 4*, P. M. Boren, February 1980.

N-1352-HUD, *Codebook for the Survey of Landlords, Site II, Wave 3*, P. M. Boren, June 1980.

N-1354-HUD, *Codebook for the Survey of Residential Buildings, Site I, Wave 4. P. M. Boren, March 1980.*

N-1355-HUD, *Codebook for the Survey of Residential Buildings, Site II, Wave 2*, P. M. Boren, June 1980.

N-1358-HUD, *Codebook for the Household Survey, Site I, Wave 4*, P. M. Boren, March 1980.

N-1359-HUD, *Codebook for the Household Survey, Site II, Wave 3*, P. M. Boren, May 1980.

N-1361-HUD, *Codebook for the Survey of Neighborhoods, Site I, Wave 4*, P. M. Boren and C. E. Hillestad, March 1980.

N-1365-HUD, *Codebook for the Attitude Module of the Landlord Survey, Site I, Wave 4*, P. M. Boren and C. J. Witsberger, March 1980.

N-1366-HUD, *Codebok for the Attitude Module on the Landlord Survey, Site I, Wave 4*, P. M. Boren and C. J. Witsberger, March 1980.

N-1368-HUD, *Codebook for the Attitude Module of the Household Survey, Site I, Wave 2*, P. M. Boren, January 1980.

N-1370-HUD, *Codebook for the Attitude Module of the Household Survey, Site I, Wave 4*, P. M. Boren, March 1980.

N-1371-HUD, *Codebook for the Attitude Module of the Household Survey, Site II, Wave 3*, P. M. Boren. June 1980.

N-1374-HUD, *Supplemental Codebook for the Household Survey, Site I, Wave 2*, S. E. Trude, E. C. Casper, R. M. Allen, January 1980.

N-1375-HUD, *Supplemental Codebook for the Household Survey, Site I, Wave 3*, E. C. Casper, R. M. Allen, and S. E. Trude, February 1980.

N-1376-HUD, *Supplemental Codebook for the Household Survey, Site I, Wave 4*, R. M. Allen, E. C. Casper, and S. E. Trude, March 1980.

N-1378-HUD, *Supplemental Codebook for the Household Survey, Site II, Wave 2*, E. C. Casper and R. M. Allen, May 1980.

N-1382-HUD, *Supplemental Codebook for the Survey of Landlords, Site I, Wave 2*, K. C. Wong, P. M. Boren, and S. E. Trude, January 1980.

N-1383-HUD, *Supplemental Codebook for the Survey of Landlords, Site I, Wave 3*, K. C. Wong, P. M. Boren, February 1980.

N-1384-HUD, *Supplemental Codebook for the Survey of Landlords, Site I, Wave 4*, K. C. Wong and P. M. Boren, March 1980.

N-1386-HUD, *Supplemental Codebook for the Survey of Landlords, Site II, Wave 2*, P. M. Boren and K. C. Wong, May 1980.

N-1389-HUD, *Supplemental Codebook for the Survey of Residential Buildings, Site I, Wave 2*, P. M. Boren, S. E. Trude, and B. F. Lowe, January 1980.

N-1390-HUD, *Supplemental Codebook for the Survey of Residential Buildings, Site I, Wave 3*, P. M. Boren and S. E. Trude, March 1980.

N-1391-HUD, *Supplemental Codebook for the Survey of Residential Buildings, Site I, Wave 4*, P. M. Boren and S. E. Trude, March 1980.

N-1393-HUD, *Supplemental Codebook for the Survey of Residential Buildings, Site II, Wave 3*, P. M. Boren, June 1980.

N-1394-HUD, *Supplemental Codebook for the Survey of Residential Buildings, Site II, Wave 3*, P. M. Boren, June 1980

N-1405-HUD, *Codebook for the Survey of Residential Buildings, Site I, Wave 3*, P. M. Boren, March 1980.

LABOR AND POPULATION STUDIES

James P. Smith, Program Director

Labor markets, economic development, income distribution and poverty, labor supply, and the determinants and consequences of population growth and its geographical distribution are the primary concerns of the Labor and Population Studies Program. The projects focus both conceptually and empirically on behavioral responses to policies that alter incentives, and on the ways in which incentive structures are determined within markets subject to particular policy influences.

Rand analyses of domestic labor markets touch on a number of dimensions of human resources, with particular emphasis on women and black Americans. Study topics have included racial income differences, the dynamics of poverty, interregional migration, and female labor supply, fertility, and wages.

Program research on economic development emphasizes the role of human resources in the process of economic development. Policy concerns under study occupy a broad spectrum: from wage growth to rural credit markets, from effects of weaning patterns to influences on schooling attainment, from the role of women in development to migration patterns. Rand is also addressing international population problems, including determinants of fertility and contraceptive use—together with family "investments" in child development—in less-developed countries.

In 1979, the Rand Population Research Center was established by a grant from the National Institute of Child Health and Human Development. The purpose of the Center is to provide a continuing basis of support for demographic research of high scientific quality and direct policy relevance. Research in the Center is initially concentrating on the demography of families and households and on the changing geographic distribution of the U.S. population.

Finis R. Welch was Director of the Labor and Population Studies Program from 1974 to 1977. James P. Smith became Program Director in the fall of 1977.

DOMESTIC LABOR MARKET

TRADE UNION OBJECTIVES, MARKET CONDITIONS, AND WAGE DETERMINATION

National Science Foundation

Term and Scale of Effort: 10/80 - 7/82; .75 person years

Principal Investigator: James N. Dertouzos

In recent decades, economists have been unable to reach a consensus about the nature of union objectives, and no empirical investigations of the issues have been made. Instead, studies have focused on the overall impact of unionism on such topics as wage rates, productivity, and the frequency of layoffs and quits. These topics are interesting, but interpretation remains difficult in the absence of any measures of the underlying relationships. Rand staff will develop a model of trade union behavior which will permit the simultaneous evaluation of several union objectives as well as an assessment of the impact of a variety of market factors on union goals, wage, and employment levels. Applying the econometric investigation of wage determination to the International Typographical Union, staff will specify a model of trade union behavior generalizable to a variety of union activities.

A DYNAMIC ECONOMETRIC MODEL OF RETIREMENT

Department of Labor

Term and Scale of Effort: 10/80 - 12/81; 2.7 person years

Principal Investigator: Michael P. Ward

Recent and proposed changes in public policy directed toward pension and retirement issues may alter workers' retirement decisions. Social Security benefits, the earnings test on these benefits, and laws bearing on the vesting and portability of private pensions will each affect the financial atrractiveness of retirement and the timing of that decision. But while the potential for policy effects is recognized, the quantitative impact of these factors is not well known. Rand staff will estimate the effects of such factors on retirement rates, and will build a model of worker decisions for use in predicting the outcome of proposed policies.

CROSS-SECTIONAL VERSUS TIME SERIES EFFECTS OF LOCAL LABOR MARKET CONDITIONS

Department of Labor

Term and Scale of Effort: 9/79 - 3/81; 1.2 person years

Principal Investigator: Lee A. Lillard

This project examines the effect of local market conditions on wages and employment. The approach is basically microeconomic, but incorporating the major features of macroeconomic time series models. Micro-models of career wage determination and labor supply will be integrated with macro-models of worker expectations in aggregate labor supply. The study should provide insights into time series observations on a large number of workers located in geographically distinct labor markets, including:

- The distributional impact on workers of changes in economic conditions.
- Differences in cross-sectional and time series effects of local market conditions.
- The role of worker expectations about future economic conditions.

THE ECONOMIC STATUS OF BLACK AMERICANS

The Ford Foundation

Term and Scale of Effort: 7/79 - 1/81; 2.2 person years

Principal Investigator: James P. Smith

This project builds on past Rand research assessing the causes of the narrowing wage gap for black and white males between 1960 and 1970, using the decennial U.S. Census. Since a complete understanding of the dynamics of black-white changes necessitates explaining the patterns of females as well, we have also expanded the wage comparisons to include women. Our findings contrast sharply with those of other research in this area, largely because of the scope of the questions that we have investigated. Our research on black-white earnings paints a far more optimistic prospectus for future earnings parity of blacks.

The current work expands past studies by analyzing pre-1960 data to determine whether our analytical conclusions covering the last 15 years are consistent with a broader historical movement. Research to date indicates that cohort effects (improved education experiences for successive generations of blacks) have been the central and most important explanation of the rise in black wages. If our hypothesis is correct, the patterns observed for the past 15 years should be consistent with those revealed in the 1940 and 1950 Census. An even longer historical series is also possible from Census data using the occupational distributions of blacks and whites from 1900 onward.

EFFECTS OF POST-SECONDARY EDUCATION AND CAREER CHOICES ON DEVELOPMENT OF SELF-CONCEPT

Department of Health, Education, and Welfare

Term and Scale of Effort: 10/78 – 5/80; 1.7 person years

Principal Investigators: David E. Kanouse and Peter A. Morrison

During the transition from adolescence to adulthood, young people make critical decisions regarding future education and career. Public policy is concerned with both the process and the consequences of those decisions. This research explored how education and career choices made after high school affect the young adult's self-concept. Using data from a longitudinal survey of the high school class of 1972, Rand has examined changes in self-esteem, values placed on various adult roles, long-term career aspirations, and educational expectations, and related these changes to critical life decisions. The results of this study will be useful in planning and evaluating federal programs designed to expand career and educational opportunities for young people, ease the burden of unemployment, and equalize opportunities across socioeconomic boundaries.

R-2616-HEW, *Effects of Postsecondary Experiences on Aspirations, Attitudes, and Changes in Self-Concept*, D. E. Kanouse, G. W. Haggstrom, T. J. Blaschke, J. P. Kahan, W. J. Lisowski, and P. A. Morrison, forthcoming.

DYNAMIC ASPECTS OF EARNINGS AND INCOME MOBILITY

National Bureau of Economic Research

Term and Scale of Effort: 10/77 – 10/78; 1 person year

Principal Investigator: Lee A. Lillard

Rand developed and applied a new methodology for analyzing income distribution and income mobility. With this methodology, which uses such longitudinal data as the Michigan Income Dynamics Panel, Rand studied the interaction between changes in national and local economic conditions and in individual worker characteristics in order to determine how the characteristics of individual workers contribute to differences in their earning and income.

"Inequality: Earnings vs. Human Wealth," L. A. Lillard, *American Economic Review*, March 1977.

"The Distribution of Earnings and Human Wealth in a Life Cycle Context," L. A. Lillard, in F. T. Juster (ed.), *The Distribution of Economic Well-Being*, Ballinger, 1977.

"Components of Variation in Panel Earnings Data," L. A. Lillard and Y. Weiss, *Econometrica*, Vol. 47, No. 2, March 1979.

P-6271, *A Dynamic Life Cycle Labor Supply Model for Prime Age Males*, L. A. Lillard, January 1979.

P-6165, *Wages and Hours in Earning Dynamics*, L. A. Lillard, January 1979.

P-6287, *Labor, Supply Response to Dynamic Wage Variation: A Model for Prime Aged Males*, L. A. Lillard, January 1979.

MIGRATION, UNEMPLOYMENT AND JOB MOBILITY

National Institutes of Health

Term and Scale of Effort: 2/78 - 8/80; 2 person years

Principal Investigators: Julie S. DaVanzo and James R. Hosek

Much uncertainty exists as to the causes and results of migration. Recent improved information about migration with corresponding sophisticated models of household decisionmaking allows researchers to provide answers to some of these uncertainties. Rand research will address three major questions: (1) Which workers are more likely to change jobs and to migrate, and how is this related to labor force status—employed or unemployed? (2) Which destination will be chosen? (3) How do post-migration earnings, employment, and unemployment compare with pre-migration experience? The findings of this project improved the understanding of the causes and consequences of migration and helped determine whether migration improves the economic efficiency of the geographic allocation of human resources.

N-1480-NICHD, *Returns to Migration: Literature Review and Critique*, J. Antel, forthcoming.

N-1554-NICHD, *Does Migration Increase Wage Rates? A Sensitivity Analysis of Alternative Techniques for Measuring the Effects of Migration*, J. S. DaVanzo and J. Hosek, April 1980.

N-1201-NICHD, *Microeconomic Approaches to Studying Migration Decisions*, J. S. DaVanzo, May 1980.

P-6133, *U.S. Internal Migration: Who Moves and Why?* J. S. DaVanzo, June 1978; reprinted as "Who Moves and Why," *Challenge, The Magazine of Economic Affairs*, September/October 1978.

P-5787, *Repeat Migration Information Costs and Location-Specific Capital*, J. S. DaVanzo, May 1980; also in *Population and Environment: Behavioral and Social Issues*, forthcoming.

THEORY AND ESTIMATION OF LABOR SUPPLY FUNCTIONS

Department of Labor

Term and Scale of Effort: 5/77 - 1/79; .6 person years

Principal Investigator: John Cogan

Rand addressed several key issues in labor supply which had been either completely neglected or treated only on a superficial level. One issue was the estimation of labor supply functions for married women when there are fixed costs of entry into the labor force. In this research project the costs of work and their effects on the labor force behavior of married women were estimated. A second or related issue was estimation of a family model of labor supply. The primary focus of this research estimated the effect of the wife's labor force status on the husband's level of work effort. A third issue was the integration of the various dimensions of married women's labor supply, such as, labor force participation, weeks worked per year, and hours worked per week.

R-2045-DOL, *Conditional Labor Supply Function*, J. F. Cogan, September 1978.

JOB SCREENING AND EARNINGS DIFFERENTIALS

National Science Foundation

Term and Scale of Effort: 6/76 - 12/78; 1.4 person years

Principal Investigator: John G. Riley

Traditional human capital theory emphasizes the beneficial effects of additional education on productivity. Individuals, it is argued, invest in education until their marginal gain in productivity equals their marginal opportunity cost. Thus a person can, by foregoing immediate earnings, augment the quality of his labor services in such a way (e.g., by acquiring a college degree) as to raise his future market value. Until recently, however, there has been little study of how information about a person's productivity is transmitted to potential buyers of his services. In effect, education (it is thought) can provide a means by which employers can screen out the less capable workers. The implications of such information acquisition are of potential importance to social policy.

To test this educational screening hypothesis, subsamples of "screened" and "unscreened" occupations were isolated and compared, on the assumption that screening is more important in some occupations than in others. Observed differences, not readily explained by traditional models, were consistent with the hypothesis.

Theoretical foundations of the view of education as information useful to employers were next studied. The main results were (a) that instability problems exist in the sense that only in special cases is each agent at his individual

optimum, but (b) that modifying the behavioral assumptions to account for plausible reactions by other agents corrects this instability. For the class of economies satisfying the basic assumption of a perfect negative correlation between productivity and schooling costs, it was established that there is a unique "reactive equilibrium" in which higher education correctly signals greater productivity.

R-2059-NSF, *Informational Equilibrium*, J. G. Riley, April 1977.

"Testing the Educational Screening Hypothesis," J. G. Riley, *Journal of Political Economy*, October 1979.

BLACK/WHITE EARNINGS AND EMPLOYMENT

National Science Foundation

Term and Scale of Effort: 5/76 – 1/82; 4.8 person years

Principal Investigator: James P. Smith

It is clear from the available data that the relative economic position of black Americans is improving, although the rate of gain and factors contributing to it are matters of dispute. Rand staff undertook an analysis of this change in the economic status of blacks using a comprehensive body of data which included the Current Population Surveys (CPSs) for the years 1968-1973, and the 1960 and 1970 censuses. In the process of analyzing these data to explain existing earnings patterns and changes, they addressed a number of issues: cyclical and secular patterns in the return to schooling, changes in the market for highly schooled labor, and the sensitivity of wages and employment among skill and race groups to fluctuations in aggregate labor demand. They found that the most important reason for the improved economic status of blacks is the narrowing of differences in the level and quality of schooling between blacks and whites.

During the second phase two books will be written on the critical role of education in the economic status of blacks (a technical book and one for a more general audience). They will also expand the previous research by identifying factors that lead to permanent improvement in the economic well-being of individuals starting life at the lowest level of the income distribution.

New analysis will seek to explain the high and rising levels of unemployment among black youths, provide an historical perspective to the findings by incorporating pre-1960 data, compare female wages using merged 1967-1975 CPS files, and identify further the determinants of income distribution within the black population.

"Black-White Male Wage Ratios, 1960-1970," J. P. Smith and F. R. Welch, *American Economic Review*, June 1977.

"Improving Economic Status of Black Americans," J. P. Smith, *American Economic Review*, May 1978.

"Local Labor Markets and Demand for College Educated Manpower," J. P. Smith and F. R. Welch, *Econometrics of Panel Data, Annales de l'Insee*, No. 30-31, April-September, Paris, 1978.

"Inequality: Race Differences in the Distribution of Earnings," J. P. Smith and F. R. Welch, *International Economics Review*, June 1979.

"Distribution of Family Earnings," J. P. Smith, *Journal of Political Economy*, October 1979.

"The Overeducated American," J. P. Smith and F. R. Welch, *Proceedings of the National Academy of Education*, 1980.

RACE DIFFERENCES IN EARNINGS, FEMALE WAGE RATES, AND LABOR SUPPLY

Department of Health, Education, and Welfare (Assistant Secretary for Planning and Evaluation)

Term and Scale of Effort: 6/74 – 12/77; 12 person years

Principal Investigator: Finis R. Welch

The increasing share of females in the labor force, proposals for federal support of day care programs for children of working mothers, and the interrelationships between a husband's earnings and a wife's marginal tax rate all suggest that females will constitute a significant part of the labor supply response associated with welfare reform. In an analysis of these recent developments, Rand identified policy-relevant dimensions of women's decisions to enter the labor force. A second part of the research built upon an analysis of changes in black/white employment and earnings patterns during 1960-1970 by emphasizing income returns to schooling and the effects of antidiscrimination legislation. The project staff assessed the relative strength of various factors contributing to this return to schooling, such as improvement in the quality of schooling and decreasing career discrimination. Other questions addressed included the relationship between wages and job amenities and the size and composition of potential labor supply populations for various types of public employment programs.

In addition, work was done on the income of black Americans, using recent survey files to update prior reseach results. The information obtained should enable a thorough investigation of whether the increase in black wage rates during the 1960s was a business cycle phenomenon or an indication of permanent change. A second area of analysis involved the extension of wage comparisons to include women.

R-1728-HEW, *Assets and Labor Supply*, J. P. Smith, May 1975.

R-1787-HEW, *Hours and Weeks in the Theory of Labor Supply*, G. Hanoch, August 1976.

R-1812-HEW/DOL, *Employment Quotas for Minorities*, F. R. Welch, May 1976.

R-1849-HEW/DOL, *The Census Occupational Taxonomy: How Much Information Does It Contain?* F. R. Welch and I. Maclennan, September 1976.

R-1869-HEW, *A Multivariate Model of Labor Supply: Methodology for Estimation*, G. Hanoch, September 1976.

R-2044-HEW, *Labor Supply with Time and Money Costs of Participation*, J. F. Cogan, October 1977.

R-2155-HEW, *Negative Income Taxation and Labor Supply: New Evidence from the New Jersey-Pennsylvania Experiment*, J. F. Cogan, February 1978.

Female Labor Supply: Theory and Estimation, J. P. Smith, Princeton University Press, 1980.

CHANGES IN BLACK/WHITE EARNINGS AND EMPLOYMENT PATTERNS, 1960-1970

Department of Labor

Term and Scale of Effort: 1/74 - 7/75; 2 person years

Principal Investigator: Finis R. Welch

Between 1960 and 1970, census data indicate that blacks' earnings increased relative to whites'. In this project, Rand performed a detailed conceptual and empirical analysis of the factors underlying that progress. The study, which assessed the impact of the 1964 Civil Rights Act on employment patterns and on black/white wage discrepancies within occupations, was designed to assist the Department of Labor in determining the extent to which government anti-discrimination policies affect earnings.

R-1666-DOL, *Black/White Male Earnings and Employment: 1960-1970*, J. P. Smith and F. R. Welch, June 1975.

REGIONAL EFFECTS OF INCOME MAINTENANCE PROGRAMS: ESTIMATING MODELS OF UNEMPLOYMENT AND LABOR SUPPLY

Department of Commerce (Economic Development Administration)

Term and Scale of Effort: 6/73 - 9/75; 2.3 person years

Principal Investigators: Julie S. DaVanzo and David H. Greenberg

In August 1969, President Nixon proposed to replace the existing welfare system with a family assistance plan or some type of income maintenance

program. The national and subnational impact of such programs is uncertain, but they would certainly affect various geographic regions differently and could alter the course of regional economic development. Rand devised econometric models of unemployment and labor supply that could be incorporated into estimations of the regional effects of different types of income maintenance programs.

R-1775-EDA, *Unemployment Patterns among Individuals*, J. R. Hosek, August 1975.

R-1785-EDA, *Regional Labor Supply Response to Negative Income Tax Programs*, D. H. Greenberg and J. R. Hosek, February 1976.

WELFARE REFORM—EVALUATION DESIGN

Office of Economic Opportunity

Term and Scale of Effort: 7/72 - 7/73; 2 person years

Principal Investigator: Dennis N. De Tray

Rand developed a general conceptual and statistical framework within which to evaluate and analyze the potential impact of different welfare reform packages on several phases of household decisionmaking, including marriage, fertility, the propensity to migrate, education, and savings. The analysis also considered the effects of alternative income maintenance programs on labor supply.

R-1121-EDA/OEO, *Family Decisionmaking Over the Life Cycle: Some Implications for Estimating the Effects of Income Maintenance Programs*, J. P. Smith, November 1973.

R-1346-OEO, *A General Economic Framework for Welfare Reform Analysis*, D. N. De Tray, July 1973.

R-1372-OEO, *Estimating Labor Supply Response: A Sensitivity Analysis*, J. S. DaVanzo, D. N. De Tray and D. H. Greenberg, December 1973.

"The Sensitivity of Male Labor Supply Estimates to Choice of Assumption," D. N. De Tray, *The Review of Economics and Statistics*, Vol. XVIII, No. 3, August 1976.

INCOME SUPPLEMENTS AND REGIONAL ECONOMIC DEVELOPMENT

Department of Commerce (Economic Development Administration)

Term and Scale of Effort: 6/71 – 12/72; 2.2 person years

Principal Investigators: Joseph P. Newhouse and T. Paul Schultz

Rand developed a theoretical and statistical framework for assessing the regional economic and demographic impact of alternative federal and state income supplement programs on various types of behavior, with emphasis on labor supply and migration.

R-1066-DOC, *A Conceptual Basis for the Study of Welfare Reform Effects*, D. N. De Tray, September 1972.

R-1081-EDA, *An Analytical Framework for Studying the Potential Effects of an Income Maintenance Program on U.S. Interregional Migration*, J. S. DaVanzo, December 1972.

R-1085-EDA, *Problems of Model Specification and Measurement: The Labor Supply Function*, D. H. Greenberg, December 1972.

R-1121-EDA/OEO, *Family Decisionmaking Over the Life Cycle: Some Implications for Estimating the Effects of Income Maintenance Programs*, J. P. Smith, November 1973.

R-1211-EDA, *Suggestions for Assessing Economic and Demographic Effects of Income Maintenance Programs*, J. S. DaVanzo and D. H. Greenberg, June 1973.

R-1265-NIH/EDA, *Estimating Labor Supply Functions for Married Women*, T. P. Schultz, February 1975.

R-1306-EDA/NIH, *Univariate and Multivariate—Log-Linear and Logistic Models*, M. Nerlove and S. J. Press, December 1973.

ECONOMIC DEVELOPMENT

THE FAMILY IN ECONOMIC DEVELOPMENT: PROMOTING GROWTH THROUGH PEOPLE

Department of State (Agency for International Development)

Term and Scale of Effort: 7/80 – 7/83; 20 person years

Principal Investigator: Dennis N. De Tray

Disappointment with the macroeconomic U.S. foreign assistance policies of the 1960s, and reservations about their distributional effects, have led to

changes in policy aims and direction. Emphasis is now being placed on the poor, especially the peasant farmers and landless workers who form the core of many developing nations' economies, and on women, the most neglected of the participants in the development process. A central theme of this project is that the success or failure of policies to promote economic growth with equity depends critically on how poor people respond to the changes in their surroundings introduced by these policies.

Staff are examining a broad spectrum of policy concerns—from patterns of contraceptive use to rural credit markets, from effects of weaning patterns to influences on schooling attainment, from the role of women in development to migration patterns.

The project's specific goals are:

- To join state-of-the-art research methods with the best available household- and community-level data to answer questions of concern to policymakers and planners in devloping countries.
- To make researchers and policymakers in developing countries more aware of recent advances in methods and data for policy analysis, through research collaboration and training.
- To distill research findings into specific policy and program options for presentation to decisionmakers in less developed countries and the U.S. Agency for International Development.

DETERMINANTS OF FERTILITY, CHILD MORTALITY, AND POPULATION GROWTH IN MALAYSIA

Department of State (Agency for International Development)

Term and Scale of Effort: 6/79 – 6/81; 5.5 person years

Principal Investigators: William P. Butz and Julie S. DaVanzo

Since World War II Malaysian reproductive behavior has changed dramatically. To provide AID with policy guidance in the area of population and health, Rand is estimating the impact of public programs and community factors on birthspacing, child survival, and completed family size. The project is also expected to contribute information of general geographic applicability in four areas—estimating the effectiveness of community programs, modeling and estimating joint behavioral and biological relationships, replicating society-wide the findings from clinical studies, and studying the usefulness of comprehensive life history and time use data. In performing these economic, demographic, and econometric analyses, staff will use detailed household and community survey data (The Malaysian Family Life Survey) gathered by the principal investigators in 1976 and 1977 in Peninsular Malaysia under an AID contract, the forerunner to this project.

N-1310-AID, *Migration and Fertility: Some Illustrative Tabulations Based on the Malaysian Family Life Survey*, J. S. DaVanzo and S. Goldstein, November 1979.

N-1544-AID, *Three Methods for Processing Life-History Data*, T. Fain, July 1980.

"The Changing Role of Breastfeeding in Economic Development: A Theoretical Exposition," W. P. Butz, in I. Sirageldin (ed.), *Research in Human Capital and Development*, Vol. II, JAI Press, 1980.

DETERMINANTS AND CONSEQUENCES OF CONTRACEPTIVE USE AND BREASTFEEDING PATTERNS IN MALAYSIA

The Rockefeller Foundation

Term and Scale of Effort: 1/79 - 1/80; 0.5 person years

Principal Investigators: Julie S. DaVanzo and William P. Butz

Reproductive behavior has changed dramatically in many developing countries since World War II. To learn more about these changes, the Agency for International Development funded Rand to survey Malaysians on the economic and institutional factors that affect breastfeeding, birthspacing, and the use of contraceptives. Project staff extended and completed the first analysis of these topics using the Malaysian Family Life Survey data.

R-2352-AID/RF, *Contracepting, Breastfeeding and Birthspacing in Peninsular Malaysia: A Model of Decisionmaking Subject to Economic and Biological Constraints*, W. P. Butz and J. S. DaVanzo, forthcoming.

ECONOMIC DEVELOPMENT, INVESTMENTS IN HUMAN CAPITAL, AND THE PERSONAL DISTRIBUTION OF INCOME

Department of State (Agency for International Development)

Term and Scale of Effort: 1/76 - 12/80; 15 person years

Principal Investigator: Finis R. Welch

Typically, as a country develops, specialized markets arise outside the household that produce many of the goods and services previously produced at home or in the nonmarket sector. With development, fewer people work in their home or fields in self-employment; more people work in the labor market for wages and salary. Adults make up a larger portion of the labor force; and as children work less in the labor market and spend more years in school, the average level of education and skill rises. As development proceeds, many other changes alter the environment in which individual and family resource allocation decisions are made, such as a decrease in the size of the living unit

and changes in institutions, technologies, and relative prices. This research focused on economic determinants of these resource allocation decisions and their implications for the distribution of wealth and income. In particular, the economic causes and consequences of decisions concerning labor supply, schooling, intra- and inter-household transfers of goods and services, migration, and unemployment are analyzed. A list of selected publications from this study includes:

R-2416-AID, *Income Inequality and the Definition of Income: The Case of Malaysia*, M. Kusnic and J. S. DaVanzo, June 1980.

"Size and Age Structure of Family Households—Exploratory Comparisons," S. Kuznets, *Population and Development Review*, Vol. 4, No. 2, 1978.

"Rural Wages, Labor Supply, and Land Reform—Theoretical and Empirical Analysis," M. R. Rosenzweig, *American Economic Review*, Vol. 68, No. 5, 1978.

"Fertility and Child Mortality Over Life-Cycle—Aggregate and Individual Evidence," T. P. Schultz, *American Economic Review*, Vol. 68, No. 2, 1978.

"Regional Inequality and Other Sources of Income Variation in Colombia," G. S. Fields and T. P. Schultz, *Economic Development and Cultural Change*, Vol. 28, No. 3, 1980.

"Villages as Interest Groups—Demand for Agricultural Extension Services in India," J. M. Guttman, *Kyklos*, Vol. 33, No. 1, 1980.

"Testing the Quantity-Quality Fertility Model—Use of Twins as a Natural Experiment," M. R. Rosenzweig and K. I. Wolpin, *Econometrica*, Vol. 48, No. 1, 1980.

"Neoclassical Theory and the Optimizing Peasant—Econometric-Analysis of Market Family Labor Supply in a Developing Country," M. R. Rosenzweig, *Quarterly Journal of Economics*, Vol. 94, No. 1, 1980.

ECONOMICS OF FERTILITY DETERMINATION AND FAMILY BEHAVIOR IN LESS-DEVELOPED COUNTRIES

The Rockefeller Foundation

Term and Scale of Effort: 7/75 - 7/79; 4 person years

Principal Investigator: Finis R. Welch

This project supports population and development studies of the behavior of family units in low-income countries. Topics addressed included:

- The demand for schooling in rural areas of the United States and low-income countries.

- The extent to which parents consider the schooling of existing children a substitute for having additional children.
- The causes of long-term fertility swings in developed countries.
- The behavioral determinants of infant and child mortality that operate through and alongside biological mechanisms.
- How family investment decisions are affected by personal and community experience of infant and child mortality.
- Changes in the pattern of women's work during the process of economic development.

R-2132-RF, *Measurement Errors and the Permanent Income Hypotheses: Evidence from Rural India*, S. S. Bhalla, May 1978.

R-2132-RF, *Measurement Errors and the Permanent Income Hypothesis: Evidence from Rural India*, S. S. Bhalla, May 1978; also in *American Economic Review*, June 1979.

"Measurement of Health and Nutrition Effects of Large-Scale Nutrition Intervention Projects," J. P. Habicht and W. P. Butz, in R. E. Klein et al. (eds.), *Evaluating the Impact of Health and Nutrition Programs*, Plenum, 1979.

P-5772, *Fertility and Child Mortality—Issues in the Demographic Transition of a Migrant Population*, Y. Ben-Porath, December 1976.

P-5699, *Some Income Distributional Effects of Technical Change*, F. R. Welch, August 1978.

P-6108, *Effects of Cohort Size on Earnings: The Baby Boom Babies' Financial Bust*, F. R. Welch, October 1979; also in *Journal of Political Economy*.

ECONOMICS OF FERTILITY AND FAMILY BEHAVIOR IN PENINSULAR MALAYSIA

Department of State (Agency for International Development)

Term and Scale of Effort: 6/74 - 4/78; 4 person years

Principal Investigators: William P. Butz and Julie S. DaVanzo

This three-year project involved gathering data and testing research hypotheses that relate reproductive behavior to other aspects of families' decisionmaking—particularly those aspects that public policy can influence. It identified and quantified key socio-economic relationships that link several important facets of family activity in Malaysia, especially economic activity, contraceptive practice, and fertility. The research indicated how seemingly disparate public programs, such as family planning and school programs, interact in affecting family members' behavior.

R-1834-AID, *Economic and Demographic Family Behavior in Malaysia: A Conceptual Framework for Analysis*, W. P. Butz and J. S. DaVanzo, October 1975.

R-2351-AID, *The Malaysian Family Life Survey: Summary Report*, W. P. Butz and J. S. DaVanzo, March 1978.

R-2351/1-AID, *The Malaysian Family Life Survey: Appendix A, Questionnaires and Interviewer Instructions*, W. P. Butz, J. S. DaVanzo, D. Fernandez, R. Jones, and N. Spoelstra, March 1978.

R-2351/2-AID, *The Malaysian Family Life Survey: Appendix B, Round One Codebook*, T. Fain and T. P. Kheong, March 1978.

R-2351/3-AID, *The Malaysian Family Life Survey: Appendix C, Field and Technical Report*, R. Jones and N. Spoelstra, March 1978.

R-2351/4-AID, *The Malaysian Family Life Survey: Appendix D, Description of Sample Questionnaires*, F. Omar, March 1978.

R-2363-AID/RF, *RETRO: A Computer Program for Processing Life History Data*, I. Maclennan, March 1978.

N-1166-AID, *Influences on Fertility and Infant Mortality in Developing Countries: The Case of Malaysia*, J. S. DaVanzo and W. P. Butz, November 1978.

P-6126, *The Compatibility of Child Care with Labor Force Participation and Nonmarket Activities: Preliminary Evidence from Malaysian Time Budget Data*, J. S. DaVanzo and D. L. P. Lee, July 1978; also in *Women in Poverty: What Do We Know?* Overseas Development Council, forthcoming.

NUTRITION, INFANT DEVELOPMENT, AND BIRTH INTERVALS

The Rockefeller Foundation

Term and Scale of Effort: 4/73 - 1/77; 3.5 person years

Principal Investigator: William P. Butz

Through an intensive survey of five rural villages in Guatemala, Rand investigated behavioral and biological relationships linking several aspects of family life, particularly child health and development, fertility, and lactation. The data collected were used to test a set of research hypotheses concerning the influences of community characteristics, such as employment opportunities and schooling, on family behavior in these areas. The research was designed to assist in an understanding of how public service programs in family planning, education, and employment can help meet goals in health and population.

R-1792-RF, *An Economic Methodology for Measuring the Benefits from Children*, W. P. Butz and D. H. Greenberg, October 1975.

R-2363-AID/RF, *RETRO: A Computer Program for Processing Life History Data*, I. Maclennan, March 1978.

N-1566, *Codebook and User's Manual: INCAP-Rand Guatemala Survey*, H. L. Corona, August 1980.

"Womens' Workload and Infant Feeding Practices: A Relationship with Demographic Implications," S. B. Nerlove, *Ethnology* 33:2, April 1974.

P-5916, *Some Uses of Integrated Demographic-Economic Data on Households in Less Developed Countries: Illustrations from a Guatemalan Survey*, W. P. Butz, H. Delgado, P. Engle, J. P. Habicht, R. Klein, B. Pillet, V. Piveral, J. Stein, C. Teller and C. Yarbrough, December 1975.

P-5962, *The Effects of Nutrition and Health on Fertility: Hypotheses, Evidence, and Interventions*, W. P. Butz and J. P. Habicht, July 1976; also in R. G. Ridker (ed.), *Population and Development: The Search for Selective Interventions*, John Hopkins University Press, 1976.

P-5759, *Notes on Using Human Capital and Household Production Models in Less Developed Countries*, W. P. Butz, November 1976; also in V. L. Urquidi (ed.), *Household Models of Economic-Demographic Decisionmaking*, IUSSP, 1980.

P-5801, *Economic Aspects of Breastfeeding*, W. P. Butz, February 1977; also in H. Mosely (ed.), *Nutrition and Reproduction*, Plenum Publishing Company, June 1977.

P-5970, *Measurement of Health and Nutrition Effects of Large-Scale Intervention Projects*, J. P. Habicht and W. P. Butz, August 1977; also in Robert E. Klein et al., *Evaluating the Impact of Nutrition and Health Programs*, Plenum Press, 1979.

DETERMINANTS OF FERTILITY IN THE UNITED STATES

National Institutes of Health

Term and Scale of Effort: 6/71 – 6/73; 3.2 person years

Principal Investigator: T. Paul Schultz

Rand pursued two research efforts under this grant. The first explored the relationship between the number of children that couples have and the background characteristics of the husband. In the second study, Rand explored alternative methods for estimating how the implementation of an income maintenance program might influence the amount of time individuals work in the labor market.

R-1117-NIH/RF, *Chance, Child Traits, and Choice of Family Size*, Y. Ben-Porath, F. R. Welch, December 1972.

R-1259-NIH, *First Generation Effects on Second Generation Fertility*, Y. Ben-Porath, December 1973.

ECONOMICS OF FERTILITY DETERMINATION AND FAMILY BEHAVIOR

The Rockefeller Foundation

Term and Scale of Effort: 3/71 - 1/75; 4.5 person years

Principal Investigator: T. Paul Schultz

For over a decade, Rand has been studying different aspects of the population problem. Initially, this research focused on interactions between man's economic and social environment and his reproductive behavior. The objective was to account for differences in the reproductive behavior among individuals and groups in low-income societies in order to isolate and evaluate policy options for reducing birth rates and enhancing the prospects of development. Under this grant from the Rockefeller Foundation, Rand expanded its basic research in this area, developing theoretical and economic approaches appropriate to the study of fertility determination and family behavior.

R-829-AID/RF, *Marriage, Fertility, and Labor Force Participation of Thai Women: An Econometric Study*, K. M. Maurer, R. Ratajczak, and T. P. Schultz, April 1973.

R-914-RF, *Changes in Mortality Levels and Family Decisions Regarding Children*, D. J. O'Hara, February 1972.

R-1003-RF, *The Interaction between Parent Investment in Children and Family Size: An Economic Analysis*, D. N. De Tray, May 1972.

R-1016-RF/AID, *Fertility Determinants: A Theory, Evidence, and an Application to Policy Evaluation*, T. P. Schultz, January 1974.

R-1079-RF, *Disequilibrium and Variation in Birth Rates Over Space and Time: A Study of Taiwan*, T. P. Schultz, September 1972.

R-1117-NIH/RF, *Chance, Child Traits, and Choice of Family Size*, Y. Ben-Porath and F. R. Welch, December 1972.

R-1510-RF, *Sex of Children: Prior Uncertainty and Subsequent Fertility Behavior*, F. R. Welch, August 1974.

R-2295-NSF, *Race Differences in Earnings: A Survey and New Evidence*, J. P. Smith and F. R. Welch, March 1978.

U.S. POPULATION

CENTER FOR POPULATION STUDIES

National Institutes of Health

Term and Scale of Effort: 9/79 – 1/81; 5.2 person years

Principal Investigator: Peter A. Morrison

The Rand Population Research Center is the first of its kind to be established by the National Institute of Child Health and Human Development outside the university community. The Center, one of a small group nationwide, is an outgrowth of a 1975 Rand-sponsored pilot study to develop the framework for a long-term program of research on how demographic change impinges on public policy. Its research focuses on the demography of families and households and the U.S. population's changing geographic distribution. Specific studies include:

- The determinants and consequences of repeat migration.
- The process of initial household formation in young adulthood.
- The impact of family size and childspacing on family level of living.
- Personal characteristics and motives of metropolitan-to-nonmetropolitan migrants in the 1970s.
- Employment trends, business cycles, and migration.

The Center will be funded at about $2 million over a five-year period. Publications to date include:

N-1347-NICHD, *The Future Demographic Context of the Health Care Delivery System*, P. A. Morrison, December 1979.

"Return and Other Sequences of Migration in the U.S," J. S. DaVanzo and P. A. Morrison, *Demography*, forthcoming.

P-6425, *The Movement of Jobs, Movement of People*, M. D. Menchik, forthcoming; also in F. G. Adams (ed.), *Modeling the Multiregional Economic System*, University of North Carolina Press, forthcoming.

P-6430, *The Service Sector in Rural America: Issues for Public Policy and Topics for Research*, M. D. Menchik, January 1980; also in A. K. Hawley and S. Mazie, *The Future of Nonmetropolitan America*, University of North Carolina Press, forthcoming.

CHANGING GEOGRAPHIC DISTRIBUTION OF THE ELDERLY

National Institute on Aging

Term and Scale of Effort: 4/80 - 9/81; 1.2 person years

Principal Investigators: Kevin F. McCarthy and Peter A. Morrison

Elderly retirees constitute a growing population of consumers whose residential choices have important implications for the localities in which they live. Because their heavy service needs differ from those of other age groups, they create special demands. The concentration of the elderly in, for example, central cities and selected nonmetropolitan communities, and the prospect that more may move to similar places in the future, make their geographic distribution a matter of considerable importance to urban and rural planners.

This project will analyze the changing distribution of the elderly between 1965 and 1977, and the area characteristics associated with redistribution. The analysis will helps us to understand the demographic processes through which elderly population becomes concentrated in certain areas and help us monitor their future concentration.

POPULATION MOBILITY AND LENGTH OF STAY

National Institutes of Health

Term and Scale of Effort: 10/79 - 12/80; 1.2 person years

Principal Investigator: Mark D. Menchik

This study analyzes population movement histories in three metropolitan areas (Wichita, Kansas; South Bend, Indiana; and Green Bay, Wisconsin) in order to answer such questions as:

- How does a household's continued stay in one place influence its probability of departing?
- How are movement rates influenced by changes in household composition?
- Is a household's propensity to move blunted by ties to its home and neighborhood? A model of individual behavior relating to movement decisions will be formulated.

This research will broaden our understanding of factors that shape duration of residence and households' propensity to stay or leave. It also will contribute to our understanding of the migration process.

R-2550-NICHD, *Analyzing the Frequency and Timing of Demographic Events*, M. D. Menchik and W. H. Rogers, forthcoming.

P-6434, *Using Administrative Records to Study Mobility: The Case of the Housing Assistance Supply Experiment*, M. D. Menchik, January 1980; also in W. A. V. Clark and E. G. Moore (eds.), *Changing the Restless*

Metropolis: The Policy Implications of Residential Mobility, Sage Publications Series, Vol. 19, 1980.

CONSEQUENCES OF LATE ADOLESCENT CHILDBEARING IN THE EARLY 1970s

National Institutes of Health

Term and Scale of Effort: 10/77 - 6/80; 4.2 person years

Principal Investigator: Peter A. Morrison

One out of every six births in the United States occurs to a mother under the age of 20. Early parenthood, both outside and within marriage, affects the teenage parents' chances in life and conceptions about themselves. Often, it destroys the prospects for a successful economic and family career, forces society to intervene with costly social services, and threatens the traditional view of the family as the basic social unit. Past research has given disproportionate emphasis to *early* adolescent childbearing, especially where this occurs out of wedlock. But the societal definition of the high-school-leaving age as the end of adolescence, and hence, of the *social* problem of adolescent childbearing may not be congruent with the experience of parenthood at a personal level. For a young man or woman, parenthood at age 18, 19 or 20 may bear a closer resemblance to parenthood at age 16 than parent-hood at 22, since parenthood at the earlier ages changes education and career aspirations and generally deflects parents from their goals. In this study, Rand staff examined the consequences of adolescent childbearing in five major areas of the adolescent parents' lives: (1) self-esteem, locus of control, adult role orientation; (2) future expectations and aspirations about work, education, and family growth; (3) women's perceptions and orientations about homemaking and work; (4) young parents' economic well-being; and (5) their economic dependency on their parents and society.

R-2647-NICHD, *Teenage Parents: Their Ambitions and Attainments*, G. W. Haggstrom, T. J. Blaschke, D. E. Kanouse, W. J. Lisowski and P. A. Morrison, forthcoming.

N-1275-NICHD, *Procedures for Estimating Parenthood and Marital Status for Respondents to the National Longitudinal Study of the High School Class of 1972*, T. Blaschke, G. W. Haggstrom, and P. A. Morrison, August 1979.

N-1343-NICHD, *Consequences of Parenthood in Late Adolescence: Findings from the National Longitudinal Study of High School Seniors*, G. W. Haggstrom, P. A. Morrison, T. J. Blaschke, and W. J. Lisowski, December 1979.

P-6272, *Investigating Adolescent Parenthood with the National Longitudinal Study of High School Seniors*, G. W. Haggstrom and P. A. Morrison, February 1979 (paper given at Workshop on Adolescent Pregnancy and Childbearing).

LONG-TERM ECONOMIC-DEMOGRAPHIC INTERACTIONS IN THE U.S.: IMPLICATIONS FOR THE SOCIAL SECURITY SYSTEM

Social Security Administration

Term and Scale of Effort: 10/76 - 1/79; 2 person years

Principal Investigator: William P. Butz

During the last decade, the Social Security System has come under increasing financial pressure, a situation many expect to worsen during the remainder of this century. Although most of the blame has fallen on the precipitous drop in birth rates since the late 1950s, and the resultant decrease in the supply of persons of labor force age relative to the number of retirees, the financial status of the Social Security System depends on a number of more complex considerations. Rand developed an economic-demographic model to supplement the actuarial forecasts in current use, incorporating some of the most important of these factors such as marriage or household formation rates, immigration, male and female labor force participation rates, the total fertility rate, and national product. The model will make it possible to simulate effects on the Social Security System under alternative assumptions concerning the future course of fertility rates and economic conditions.

N-1304-SSA, *Labor Markets and Fertility: Demographically Disaggregate Model of U.S. Postwar Experience*, W. P. Butz, M. P. Ward, and D. Negri, September 1979.

"Countercyclical U.S. Fertility and Its Implications," W. P. Butz and M. P. Ward, *Social Security Bulletin*, Vol. 42, No. 8, August 1979.

"Baby Boom and Baby Bust: A New View," W. P. Butz and M. P. Ward, *American Demographics*, Vol. 1, No. 8, September 1979.

DETERMINANTS OF ECONOMIC SUCCESS AMONG MIGRANTS

National Institutes of Health

Term and Scale of Effort: 6/76 - 6/78; 1.2 person years

Principal Investigator: Peter A. Morrison

Migration is often viewed as a means of broadening access to opportunity. It is apparent, though, that obtaining a better position in the labor market is related not only to changes of locale, but also the the attributes of persons who choose to move, such as higher educational attainment and occupational status, and orientation toward occupational advancement. Rand investigated the extent to which advantageous changes resulting from migration are, in fact, complemented by the characteristics of people who tend to migrate, concentrating on three poverty-prone subpopulations: Northern blacks, non-college-attending youth, and marginal earners.

"Migration Patterns and Income Change: Implications for the Human Capital Approach to Migration: Comment," J. S. DaVanzo, *Southern Economic Journal*, 44 (2), October 1977.

P-5729, *The Image of "Elsewhere" in the American Tradition of Migration*, P. A. Morrison and J. P. Wheeler, October 1976; also in W. H. McNeill and R. S. Adams (eds.), *Human Migration: Patterns, Policies, Implications*, Indiana University Press, 1978.

P-6079, *How Demographers Can Help Members of Congress*, P. A. Morrison, March 1978; reprinted as "How Demographers Can Help Legislators," *Policy Analysis*, 6(1), Winter 1980.

P-6118, *Small Cities: How Can the Federal and State Governments Respond to Their Diverse Needs?* P. A. Morrison, May 1978 (hearings before the Subcommittee on the City, 95th Congress, Second Session).

P-6133, *U.S. Internal Migration: Who Moves and Why?* J. S. DaVanzo, June 1978 (testimony before the House of Representatives Select Committee on Population).

AN ECONOMIC ANALYSIS OF THE CONSEQUENCES OF CHILD SPACING AND RELATED FERTILITY BEHAVIOR

National Institutes of Health

Term and Scale of Effort: 7/75 – 5/78; 2.6 person years

Principal Investigators: Dennis N. De Tray and James P. Smith

This project was concerned with interrelationships between the timing, spacing, and numbers of children couples have, and parent and child economic welfare. The first task considered the effect of parity and number of siblings on child economic well-being through an analysis of the determinants of schooling received by children. The analysis was performed in the context of a model where both family size and investments in children are variables of parental choice. The second task concerned effects of timing, spacing, and family size on parent economic well-being. Two dimensions of this problem were emphasized: the effect of fertility-related behavior on consumption and savings patterns over the life cycle, and the relationship between a wife's earnings and her prior (and expected) fertility experience.

R-2301-NICHD, *Child Schooling and Family Size: An Economic Analysis*, D. N. De Tray, forthcoming.

R-2310-NICHD, *Family Formation, Labor Market Experience, and the Wages of Married Women*, J. F. Cogan and F. Berger, May 1978.

N-1279-NICHD, *Asset Accumulation and Family Size*, J. P. Smith and M. P. Ward, September 1979.

"Asset Accumulation and Family Size," J. P. Smith and M. P. Ward, *Demography*, August 1980.

ECONOMIC-DEMOGRAPHIC FACTORS IN U.S. FERTILITY TRENDS

National Institutes of Health

Term and Scale of Effort: 5/75 – 6/78; 4.6 person years

Principal Investigators: William P. Butz and Dennis N. De Tray

The several long trends in U.S. population growth rates that have occurred since 1900 are among the least understood of this century's demographic phenomena. To further an understanding of the course of past population growth, and thereby improve the ability to anticipate future changes, Rand engaged in a theoritical and empirical research project concerning fertility and family behavior. Staff explored fertility experience in the United States since World War II through the construction of an econometric model of fertility and the U.S. Labor market. This research produced a new interpretation of the baby boom and baby bust. An implication is that U.S. fertility rates will probably remain low in the coming decades.

R-1605-NIH, *The Emergence of Countercyclical U.S. Fertility*, W. P. Butz and M. P. Ward, June 1977; also in *The American Economic Review*, Vol. 69, No. 3, June 1979.

R-2285-NICHD, *Completed Fertility and Its Timing: An Economic Analysis of U.S. Experience, Since World War II*, M. P. Ward and W. P. Butz, April 1978; reprinted as "Completed Fertility and Its Timing," *Journal of Political Economy*, October 1980.

"Baby Boom and Baby Bust: A New View," W. P. Butz and M. P. Ward, *American Demographics*, Vol. 1, No. 8, September 1979.

"Will U.S. Fertility Remain Low? A New Economic Interpretation," W. P. Butz and M. P. Ward, *Population and Development Review*, Vol. 5, No. 4, December 1979.

P-6263, *Countercyclical U.S. Fertility and Its Implications*, W. P. Butz and M. P. Ward, November 1978; also in *Social Security Bulletin*, Vol. 42, No. 8, August 1979.

P-6323, *The F-Connection: Families, Friends and Firms, and the Organization of Exchange*, Y. Ben-Porath, December 1978; also in *Population and Development Review*, Vol. 6, No. 1, March 1980.

DETERMINANTS AND IMPLICATIONS OF RETURN MIGRATION

National Institutes of Health

Term and Scale of Effort: 5/75 – 2/78; 2.4 person years

Principal Investigator: Peter A. Morrison

Over the past two decades, the increasing number of persons returning to their former place of residence has had a significant impact in certain areas

of the United States. Rand identified the social and economic determinants of return migration, and analyzed its potential effects on contemporary trends in population redistribution.

N-1167-NICHD/EDA, *The Transition to Zero Population Growth in the Midwest*, P. A. Morrison, May 1979.

"The Shifting Regional Balance," P. A. Morrison, *American Demographics*, May 1979.

P-5913, *Dynamics of Return Migration: Descriptive Findings From a Longitudinal Study*, J. S. DaVanzo and P. A. Morrison, March 1978.

P-6128, *Overview of Demographic Trends Shaping the Nation's Future*, P. A. Morrison, May 1978 (testimony before the Joint Economic Committee, U.S. Congress, May 31, 1978); reprinted as "Beyond the Baby Boom," in *The Futurist*, April 1979.

P-5961, *Repeat Migration in the U. S.: Who Moves Back and Who Moves On?* J. S. DaVanzo, June 1978.

P-5851, *Migrants Who Return: Findings from a Longitudinal Study*, J. S. DaVanzo, forthcoming; reprinted as "Return and Other Sequences of Migration in the U.S." in *Demography*, forthcoming.

P-5596, *Demographic Trends that will Shape the Future Housing Demand*, P. A. Morrison, February 1976; also in *Policy Sciences*, Vol. 8, 1977.

THE IMPACT OF HUMAN RESOURCES DEVELOPMENT POLICIES ON GEOGRAPHIC MOBILITY

Department of Labor

Term and Scale of Effort: 7/73 - 1/77; 2 person years

Principal Investigator: Julie S. DaVanzo

Manpower policies such as public employment, work incentive programs, or income maintenance programs are not designed specifically to affect migration, but they may, in fact, change people's perceptions of the costs and benefits of moving. Rand assessed the effects of such human resource development policies on the volume, direction, and demographic composition of interregional migration flows in the United States and analyzed how alternative policies would affect population redistribution.

R-1972-DOL, *Why Families Move: A Model of the Geographic Mobility of Married Couples*, J. S. DaVanzo, September 1976.

P-5786, *Does Unemployment Affect Migration? Evidence from Micro Data*, J. S. DaVanzo, November 1978; also in *Review of Economics and Statistics*, November 1978.

A PROJECTIVE MIGRATION MODEL FOR POLICY ASSESSMENT

National Institutes of Health

Term and Scale of Effort: 6/71 - 5/74; 2.5 person years

Principal Investigator: Peter A. Morrison

Each year about 13 million people nationally move to a different community for a variety of reasons, usually for economic betterment. Certain places, mostly cities, attract a disproportionate number of these migrants, which results in some urban areas growing rapidly while others grow slowly or decline in population with consequent pressures on economic and social structures within the area. If a national urban growth policy were deemed feasible and desirable, migrants would represent a vast potential resource for changing patterns of urban development. The aim of this study was to develop a data-based theory of migration for projecting future patterns of population redistribution and for estimating the effects of redistribution policies.

R-1103-EDA/FF/NIH, *Migration from Distressed Areas: Its Meaning for Regional Policy*, P. A. Morrison, 1973.

"Theoretical Issues in the Design of Population Mobility Models," P. A. Morrison, *Environment and Planning*, 1973.

"Chronic Movers and the Future Redistribution of Population," P. A. Morrison, *Demography*, 1971.

"The Role of Migration in California's Growth," P. A. Morrison, in K. Davis and F. Styles (eds.), *California's Twenty Million: Research Contributions to Public Policy*, Institute of International Studies, University of California, 1971.

P-4752, *The Impact and Significance of Rural-Urban Migration in the United States*, P. A. Morrison, March 1972 (testimony before U.S. Senate Subcommittee on Migratory Labor and Public Welfare).

P-4801, *Future Urban Growth and the Nonmetropolitan Population*, P. A. Morrison, March 1972.

P-4869, *Uses of the Social Security Work History Sample in Studying Metropolitan Migration*, P. A. Morrison, July 1972.

P-5007, *How Population Movements Shape National Growth*, P. A. Morrison, May 1973.

P-5212, *Guiding Urban Growth: Policy Issues and Demographic Constraints*, P. A. Morrison, May 1974.

P-5357, *Toward a Policy Planner's View of the Urban Setlement System*, P. A. Morrison, January 1975; also in condensed form in L. S. Bourne and J. W. Simmons (eds.), *Systems of Cities*, Oxford University Press, 1978.

P-5379, *Recent Research Insights into Local Migration Flows*, P. A. Morrison and D. A. Relles, February 1975.

P-5447, *Overview of Population Forecasting for Small Areas*, P. A. Morrison, June 1975; also in *Population Forecasting for Small Areas*, Oak Ridge Associated Universities, 1977.

REGULATORY POLICIES AND INSTITUTIONS

Charles E. Phelps, Program Director

Research under the Regulatory Policies and Institutions Program has two objectives: first, to investigate the effects of regulation on the entities being regulated, and second, to improve the understanding of how regulatory processes and institutions function. The aim is to assist governmental bodies in making appropriate choices concerning when and whether particular regulatory processes and institutions ought to be employed.

Many current and recent Rand projects relate either directly or indirectly to regulation. Projects in energy, health, urban policy, and housing, for example, all have their regulatory components. The Regulatory Program thus complements other Rand domestic programs by carrying out cross-cutting research.

The Regulatory Policies and Institutions Program was created in 1978 under the direction of George Eads. Charles E. Phelps became Program Director in 1979.

EFFICIENT USE OF CALIFORNIA WATER

State of California (Assembly), The Rockefeller Foundation, and Rand-Sponsored Research

Term and Scale of Effort: 10/76 - 1/79; 7 person years

Principal Investigator: Charles E. Phelps

In this study of California's water system, Rand has placed particular emphasis on the efficiency with which water resources are being used. Efficiency of water use has an explicit meaning: the value of water to each user is equated with the value of additional resources required to deliver the water. The project staff have analyzed the complex jurisdictional and political problems surrounding water use allocation and costs, and the effects of current water pricing and allocation on agricultural practices and urban development. Through an analysis of the long-range implications of existing policy, the study was designed to assist the California legislature in formulating alternative water management policies to increase efficiency of use. Rand also studied the environmental implications of water policy, addressing such issues as the construction of water diversion and storage facilities, changes in land use and agricultural markets, the relationship between water use and energy use, and the effects of water rights law on the natural flow patterns of California water.

R-2385-CSA/RF, *Efficient Water Use in California: Executive Summary*, C. E. Phelps, M. H. Graubard, D. L. Jaquette, A. J. Lipson, N. Y. Moore, R. Shishko, and B. M. Wetzel, November 1978.

R-2386-CSA/RF, *Efficient Water Use in California: Water Rights, Water Districts, and Water Transfers*, C. E. Phelps, N. Y. Moore, and M. H. Graubard, November 1978.

R-2387/1-CSA/RF, *Efficient Water Use in California: Groundwater Use and Management*, D. L. Jaquette, N. Y. Moore, and A. J. Lipson, November 1978.

R-2387/2-CSA/RF, *Efficient Water Use in California: The Evolution of Groundwater Management in Southern California*, A. J. Lipson, November 1978.

R-2388-CSA/RF, *Efficient Water Use in California: Economic Modeling of Groundwater Development with Applications to Groundwater Management*, B. M. Wetzel, November 1978.

R-2389-CSA/RF, *Efficient Water Use in California: Conjunctive Management of Ground and Surface Reservoirs*, D. L. Jaquette, November 1978.

R-2390-CSA/RF, *Efficient Water Use in California: Water Supply Planning*, N. Y. Moore, M. H. Graubard, and R. Shishko, November 1978.

ECONOMIC FEASIBILITY OF REGULATORY OPTIONS FOR CONTROLLING FLUOROCARBON EMISSIONS FROM NON-AEROSOL SOURCES

Environmental Protection Agency

Term and Scale of Effort: 9/77 – 3/80; 7 person years

Principal Investigator: Adele R. Palmer

Beginning about 1974, concern began to be expressed by scientists that emissions of chlorofluorocarbons into the atmosphere from a variety of sources might eventually reduce the level of stratospheric ozone in the atmosphere. Consequently, there would be an increase in the incidence of skin cancer, an earlier onset of skin aging, and a variety of disturbances in aquatic and terrestrial ecosystems. By mid-1977, the scientific evidence on the question had accumulated to the point where the Environmental Protection Agency, the Food and Drug Administration, and the Consumer Product Safety Commission jointly proposed a ban on fluorocarbon-propelled aerosol sprays. The Environmental Protection Agency took note of the existence of other significant emission sources and announced its intention to explore the feasibility of bringing these sources under some means of control. To assist EPA in making a determination regarding these non-aerosol products, Rand staff have:

- Evaluated the adequacy of the existing data base on substitute non-aerosol products.
- Provided EPA with a detailed description of the affected industries.
- Developed a baseline forecast as to the likely course for these industries "in the absence of Federal regulatory actions over the next 15 years."
- Identified a series of alternative regulatory scenarios, including direct regulation, marketable quotas, and fees.
- Conducted an analysis of the most likely economic impact of each.

R-2524-EPA, *Economic Implications of Regulating Chlorofluorocarbon Emissions from Non-Aerosol Applications*, A. R. Palmer, W. E. Mooz, T. H. Quinn, C. Wolf, Jr., June 1980.

R-2575-EPA, *Economic Implications of Regulatory Non-Aerosol Chlorofluorocarbon Emissions: An Executive Briefing*, A. R. Palmer et al., July 1980.

N-1472-EPA, *Flexible Urethane Foams and Chlorofluorocarbon Emissions*, W. E. Mooz, T. H. Quinn, June 1980.

N-1483-EPA, *Regulating Chlorofluorocarbon Emissions: Effects on Chemical Production*, K. A. Wolf, August 1980.

PROJECTED ECONOMIC AND WEALTH EFFECTS OF LARGE REDUCTIONS IN THE USE OF CHLOROFLUOROCARBONS

Environmental Protection Agency

Term and Scale of Effort: 10/80 – 10/82; 5.2 person years

Principal Investigator: Adele R. Palmer

Four research tasks are addressing issues related to the regulation of chlorofluorocarbons (CFCs) believed to be hazardous to the earth's protective layer. The tasks, extensions of previous Rand research on CFC regulations, are aimed at:

- Examining opportunities for the Environmental Protection Agency to compensate CRC-using industries for costs imposed by regulation.
- Studying the economic implications of policies that would require larger cutbacks in CFC use than were specified in the earlier Rand work.
- Preparing a study plan for monitoring the economic impact of CFC regulation if actually implemented.
- Examining the implications of a policy for technological innovation that might make reductions in CFC use less costly, both in the United States and in other countries.

TECHNICAL ASSESSMENT OF METHODS FOR REDUCING CHLOROFLUOROCARBON EMISSIONS

Environmental Protection Agency

Term and Scale of Effort: 10/80 – 1/82; 5.0 person years

Principal Investigator: William E. Mooz

Rand staff are analyzing the use of chlorofluorocarbons (CFCs) in nonaerosol applications with the objective of reducing CFC emissions. These applications include the use of CFCs in refrigeration and air conditioning, as industrial solvents, and in the manufacture of insulating, packaging, and cushioning foams. Each of these applications has a different purpose, and emissions in each application may occur at different points in the life of the product concerned. Staff are examining emission control technologies, work practices, chemical substitutes for CFCs, and product substitutes for their potential to reduce CFC emissions.

STRATEGIES FOR ENFORCING ENVIRONMENTAL REGULATION

Environmental Protection Agency

Term and Scale of Effort: 6/80 – 6/81; 3.5 person years

Principal Investigator: Thomas K. Glennan, Jr.

The Office of Enforcement of the Environmental Protection Agency faces tasks of increasing complexity and urgency as statutory authority under the air and water acts matures. This increase in complexity comes at a time of rising public concern over the economic burdens of regulation. Yet experiences such as Love Canal reinforce public awareness that effective, comprehensive, and well-enforced environmental regulation can make an important contribution to national welfare.

This project supports the development and evaulation of enforcement strategies for a variety of environmental regulations. It is intended to identify the elements of enforcement strategies, criteria by which to evaluate these strategies, and possible implementation problems such as perverse organizational incentives and data handling requirements. To this end, project staff are studying the organization and operations of the Office of Enforcement and its history of regulatory program enforcement activities, as well as other enforcement efforts in other regulatory agencies.

POLLUTION, PROPERTY RIGHTS, AND PUBLIC POLICY

Environmental Protection Agency

Term and Scale of Effort: 5/80 – 5/81; .4 person years

Principal Investigator: Timothy H. Quinn and Charles E. Phelps

Most existing theories of experimental regulation treat regulatory decisions as though they were taken independently of the activities of affected groups in the private sector. This study is examining the regulatory decision-making process and its allocative and distributive consequences in the private sector. An economic model of environmental regulation is being developed and tested in which the choice of a regulatory policy as well as the reactions of the private sector to it are endogenous. The formation of regulatory policy is thus examined in the context of the who gains and who loses under alternative policy choices.

The ultimate goal of the research is a better understanding of environmental problems and of regulation as a means of organizing economic activity. Of particular interest will be insights into how politically constrained regulatory policies might be designed to achieve public goals efficiently.

NEWSPAPER CHAINS, SMALL BUSINESS ECONOMIES OF SCALE, AND GOVERNMENT POLICY

Small Business Administration

Term and Scale of Effort: 9/80 - 1/82; 1.5 person years

Principal Investigator: James N. Dertouzos

Small businesses are usually considered an important source of new products and technologies. Policymakers are concerned that it is becoming increasingly difficult for small businesses to enter and survive in the present economic environment dominated by large corporations. Large enterprises can produce at a lower per unit cost than most small enterprises, and can cope more readily with the burdens imposed by government regulations. Capital gains tax laws, together with Securities and Exchange Commission and Occupational Safety and Health Administration regulations, place disproportionate burdens on small companies, making them incapable of competing with large corporations in capital markets.

Staff are examining federal government taxes and regulations in the context of the newspaper industry. This industry is ideal for study because of its unique structure, the availability of detailed microeconomic data on firm size and innovation, certain technological and pecuniary economies, and governmental influence in the escalating growth of newspaper chains. The hypothesis being tested is that the growth of newspaper chains is due primarily to tax codes and regulations rather than to "real" economic incentives. If proven, a revision in government policy toward the newspaper industry and small business in general may be desirable.

THE ROLE OF CROSS-SUBSIDIZATION IN FEDERAL REGULATION

National Science Foundation

Term and Scale of Effort: 9/77 - 6/79; 1.6 person years

Principal Investigator: George C. Eads

Most of the regulatory agencies that economists have traditionally studied —the ICC, the CAB, etc.—have jurisdictional boundaries roughly corresponding to one or at most two industries. Thus, it is not surprising that most studies relating to these agencies' activities have been industry-specific. This project took a different approach. In it, Rand staff examined how a single issue—cross-subsidy—has been viewed by a number of these agencies. *Cross-subsidization is defined as the charging of a higher price (or requiring a higher price to be charged) in one area of service of a multi-product enterprise in order to reduce prices in another area of service of that same enterprise.* Staff focused on both the motives of the regulators to engage in cross-subsidy activities and their ability to achieve success. It was found that, whatever the motives for cross-subsidization, forces including technology and particularly competition—

either from within or from outside the regulated industry—tend to erode any "super-normal" profits with which the regulator may attempt to cross-subsidize other services.

R-2325-NSF, *The Role of Cross-Subsidization in Federal Regulation*, G. C. Eads, forthcoming.

URBAN POLICY

Barbara R. Williams, Program Director

The central concern of the Urban Policy Program is to identify levers that local, state, and federal policymakers might use to manage more effectively and equitably the structural changes taking place in metropolitan areas of the United States. Studies in the program are of two major types: those that examine the effects of federal, state, and local policies on residential location, public service delivery, and the fiscal and economic condition of metropolitan areas; and those that analyze the process of urban structural change, especially in patterns of residential and business location, neighborhood composition, and population movements among metropolitan areas.

DEPLOYMENT OF FIREFIGHTING RESOURCES IN THE CITY OF CHICAGO

City of Chicago

Term and Scale of Effort: 10/80 - 11/80; .4 person years

Principal Investigator: Warren E. Walker

Rand staff and Chicago Fire Department personnel will study the deployment of firefighting resources in that city for the relationship between various possible deployment policies and the resulting level of fire protection. The aim is to ensure that the city's firefighting resources—men and equipment—are available where and when they are needed, in appropriate numbers.

In Phase I of this two-phase study, project staff are examining the Chicago Fire Department and its deployment policies, determining the methods for collecting needed data, and obtaining insights into indicated types of deployment changes. In Phase II the actual analysis will be carried out.

STUDY OF METROPOLITAN CLEVELAND'S ECONOMY

The Cleveland Foundation

Term and Scale of Effort: 10/80 - 10/81; 2 person years

Principal Investigator: G. Thomas Kingsley

The Cleveland Foundation has requested Rand to assess opportunities for and barriers to the economic development of metropolitan Cleveland. The study will identify the prospects for growth in specific industries. Consideration will be given to the region's population, labor force and physical resources; and to the finance, regulatory and tax environment facing business and industry. A major objective of the project will be the development of an orderly data base on the economic and demographic condition of Cleveland, and a proposed strategy for establishing an ongoing economic monitoring capability for the Cleveland region.

CONTRACTION OF LOCAL GOVERNMENT: WHO GAINS? WHO LOSES?

The Ford Foundation

Term and Scale of Effort: 7/79 - 8/81; 3.2 person years

Principal Investigators: Anthony H. Pascal and Mark D. Menchik

The fiscal limitation movement—the so-called tax revolt—may bring about an end to growth in local government. This project, a sequel to an earlier Rand project (see *The Fiscal Limitation Movement: The California Case and an Agenda for Research*), addresses potential changes in the relative well-being of various groups of the population resulting from fiscal contraction of local government. Specifically, we are focusing on (1) changes in service for

children, and the poor brought about by reduced fiscal resources, and (2) changes in taxes paid, where taxpayers are classified by income, residential tenure, and location. Data will be collected in a number of communities in three states (California, Kansas, and New Jersey). The findings should aid a wide range of elected officials, administrators, and representatives of public interest groups by identifying the consequences of fiscal limitation measures and suggesting appropriate compensatory policies. Government agencies and others concerned with children, the poor, and minorities should be interested in the findings. The project sponsored a conference to disseminate findings to state and local government officials.

R-2644-FF, *How Fiscal Containment Affects Service Delivery*, M. D. Menchik and J. Fernandez, forthcoming.

R-2645-FF, *The Equity Effects of Fiscal Containment*, A. H. Pascal, M. D. Menchik, D. N. De Tray and J. Fernandez, forthcoming.

R-2646-FF, *How Fiscal Containment Affects Tax Burdens*, A. H. Pascal, D. N. De Tray, J. Fernandez, forthcoming.

N-1564-FF, *The Incidence of State and Local Taxes under Fiscal Change: Methodology*. D. N. De Tray, July 1980.

P-6471, *User Charges, Contracting Out, and Privatization in an Era of Fiscal Retrenchment*, A. H. Pascal, April 1980; also in *The Urban Interest*, October 1980.

P-6469, *The Equity Effects of Restraints on Taxing and Spending*, M. D. Menchik and A. H. Pascal, May 1980.

PUBLIC FINANCE AND ECONOMIC DEVELOPMENT RESEARCH

Department of Housing and Urban Development (Office of Policy Development and Research)

Term and Scale of Effort: 10/78 - 9/81; 2.2 person years

Principal Investigator: G. Thomas Kingsley

Rand is engaged in multidisciplinary research on issues of public finance and economic development to assist the Department of Housing and Urban Development (HUD) and other policymakers in evaluating and formulating economic and community development programs. Possible areas of study include the impact, incidence, efficiency, and equity implications of public expenditures and taxes; intergovernmental fiscal relations; urban fiscal and economic development problems; analyses of the economic functions of urban areas, and of the patterns of urban and regional growth; locational incentives for economic activities; the impact of the public sector on locational decisions; and policy options for economic development. Specific projects are:

- *Research Priorities for Public Finance and Economic Development.* A discussion of current issues in urban public finance and economic development intended to aid HUD's Office of Policy Development and Research in developing research priorities.
- *Impacts of Section 8 and Public Housing Programs.* This analysis of the major economic impacts (direct and indirect) of HUD's Section 8 and public housing programs on different population groups, jurisdictions, and regions was part of a broader HUD effort to develop a systematic approach for assessing the spatial effects of federal programs and policies.
- *Catalog of Small City Data.* Rand has compiled a catalog of social, economic, and financial data available for smaller urbanized areas. It identifies and describes the contents and locations of data bases containing information on such areas.
- *The Service Sector in Urban Revitalization.* Service industries are a rapidly growing sector in the American economy. This research seeks to improve our understanding of service sector expansion in urban revitalization.
- *Suburban Decline: Its Nature, Location, and Implications for HUD Policy.* Older inner-ring suburbs are susceptible to the social and economic changes common to central cities and may be increasingly vulnerable to the problems engendered by these changes. This task order is aimed at detailing for HUD's public finance and economic development program staff the nature, location, scope, and implications of suburban decline. The research will also assess the types of situations in which federal intervention may be warranted.

R-2612-HUD, *City Data: A Catalog of Data Sources on Small Cities*, S. J. Carroll, M. N. Caggiano, K. F. McCarthy, P. A. Morrison, and B. Quint, July 1980.

N-1446-HUD, *Pilot Urban Impact Analysis: HUD Conventional Low Rent Public Housing and Section 23 Leased Housing Program*, R. Dubinsky, August 1979.

N-1017-HUD, *Pilot Urban Impact Analysis: HUD's Section 8 New Construction and Substantial Rehabilitation Programs*, G. T. Kingsley and D. Both, August 1979.

N-1298-HUD, *The Relevance to HUD of Recent Scholarly Research in Urban Economics*, S. J. Carroll, A. H. Pascal, and M. N. Caggiano, October 1979.

P-6348, *Agglomeration Economies, Search Costs and Industrial Location*, A. H. Pascal and J. J. McCall, June 1979; also in *Journal of Urban Economics*, January 1981.

THE FISCAL LIMITATION MOVEMENT: THE CALIFORNIA CASE AND AN AGENDA FOR RESEARCH

The Ford Foundation and Rand-Sponsored Research

Term and Scale of Effort: 8/78 – 6/79; 1.5 person years

Principal Investigators: Anthony H. Pascal and Mark D. Menchik

The passage of California's Proposition 13 in June 1978 ushered in a fiscal limitations movement beset with questions and problems. In this preliminary study Rand staff examined some of the causes and consequences of this law and similar legislation now being considered by a number of states. An agenda for future research on fiscal limitations and a plan for dissemination of the study findings were produced. Such research will provide guidance to governmental decisionmakers and the public as they assess the desirability of implementing fiscal limitation laws.

R-2494-FF/RC, *Fiscal Containment of Local and State Government*, A. H. Pascal, M. D. Menchik, J. M. Chaiken, P. L. Ellickson, W. E. Walker, D. N. De Tray, and A. M. Wise, September 1979.

R-2494/1-FF/RC, *Fiscal Containment: Who Gains? Who Loses? An Executive Summary*, A. H. Pascal, M. D. Menchik, J. M. Chaiken, P. L. Ellickson, W. E. Walker, D. N. De Tray, and A. M. Wise, September 1979; also in *New York Affairs*, Fall 1980, and B. Raven (ed.), *Policy Studies Review Annual*, Vol. 4, Sage Publications, 1980.

N-1160-FF, *The Fiscal Limitation Movement: Present Context and Outlook*, P. L. Ellickson, May 1979.

N-1200-RC, *Growth in Municipal Expenditures: A Case Study of Los Angeles*, J. M. Chaiken and W. E. Walker, June 1979.

P-6332, *The Effects of Local Fiscal Contraction on Public Employment and the Advancement of Minorities*, A. H. Pascal, May 1979; also in *Southern California Law Review*, Vol. 53, No. 1, November 1979.

ASSESSMENT OF HUD'S ECONOMIC AND COMMUNITY DEVELOPMENT PROGRAMS

Department of Housing and Urban Development

Term and Scale of Effort: 1/78 – 4/78; .3 person years

Principal Investigators: Barbara R. Williams and Anthony H. Pascal

Major economic, technological, and demographic changes in American society have altered, sometimes dramatically, its urban landscape. Many older cities have fiscal problems as a result of economic and population decline. HUD conducts several programs expressly designed to sustain and enhance the overall development of cities and neighborhoods. Rand defined major

issues in urban economic and community development and assessed the extent to which HUD programs address these issues.

N-1585-HUD, *Appraising HUD Strategies for Economic and Community Development: An Analysis of the CDBG, Section 312, and UDAG Programs*, A. H. Pascal and B. R. Williams, September 1980.

EVALUATION OF EDA'S URBAN ECONOMIC DEVELOPMENT ACTIVITIES WITHIN THE CONTEXT OF OTHER FEDERAL URBAN DEVELOPMENT EFFORTS

Department of Commerce (Economic Development Administration)

Term and Scale of Effort: 10/77 – 5/79; 4 person years

Principal Investigator: Georges G. Vernez

Regional disparities in the economic development of cities and economic declines, particularly in some central cities, is a critical national problem and has been for nearly two decades. In the recent past, it has brought some cities to the brink of backruptcy, and more generally forced reductions in public services and in the maintenance and replacement of their capital stock. It may have lowered employment opportunities for many, particularly youths and minorities, and has promoted factionalism between the sunbelt and frostbelt regions. Today, attention is focused on the need for a national urban economic development policy that might address these problems. This study will aid EDA and other policymakers in determining the form and content of such a policy.

R-2372-EDA, *Federal Activities in Urban Economic Development*, G. G. Vernez, R. J. Vaughan, R. K. Yin, and A. H. Pascal, April 1979.

ASSESSMENT OF THE COUNTERCYCLICAL USE OF PUBLIC WORKS AND PUBLIC EMPLOYMENT PROGRAMS

Department of Commerce (Economic Development Administration)

Term and Scale of Effort: 10/76 – 2/79; 5.1 person years

Principal Investigator: Georges G. Vernez

Building upon earlier research on the use of public works as a countercyclical device (see below), this project included an analysis of issues affecting the design and effectiveness of a public service employment program. The issues raised by a countercyclical "public service" employment program differ, at least in degree, from those raised by a "public works" program. While labor requirements for public works projects are mainly determined by the nature of the project, public service employment provides a greater potential for targeting pre-specified groups of unemployed.

R-1990-EDA, *Public Works as a Countercyclical Device: A Review of the Issues*, R. J. Vaughan, July 1976.

R-2214-EDA, *Assessment of Countercyclical Public Works and Public Service Employment Programs*, G. G. Vernez, and R. J. Vaughan, September 1978.

R-2647-EDA, *Indicators of Local Area Cyclical Distress*, R. B. Victor and G. G. Vernez, forthcoming.

ROUTINIZATION OF NEW TECHNOLOGY BY LOCAL AGENCIES

National Science Foundation

Term and Scale of Effort: 6/76 – 2/78; 2.4 person years

Principal Investigator: Robert K. Yin

Technological innovations (hardware, computer systems, or data analytic devices) are a potential means of improving the efficiency and quality of local services such as police protection, education, and public works. The project staff examined about 150 innovative experiences in local agencies, focusing mainly on events that had occurred since their initial adoption. In this way, the study uncovered some of the factors leading to either the everyday use of or the post-adoption rejection of such innovations.

R-2277-NSF, *Changing Urban Bureaucracies: How New Practices Become Routinized*, R. K. Yin, S. K. Quick, P. M. Bateman, and E. L. Marks, March 1978.

R-2277/1-NSF, *Changing Urban Bureaucracies: How New Practices Become Routinized, Vol. II, Appendixes*, R. K. Yin, S. K. Quick, P. M. Bateman, and E. L. Marks, March 1978.

Changing Urban Bureaucracies: How New Practices Become Routinized, R. K. Yin, D. C. Heath and Company, 1979.

LOCAL GOVERNMENT EXPERIENCE AND PROBLEMS IN ADOPTING EMERGENCY SERVICE DEPLOYMENT METHODS

Department of Housing and Urban Development

Term and Scale of Effort: 6/76 – 5/77; .1 person years

Principal Investigator: Jan M. Chaiken

Under previous contracts from HUD, the New York City-Rand Institute had designed and tested a number of emergency service (e.g., fire, police, ambulance) deployment methods in selected cities. To ensure the widespread and successful application of the models and computer programs developed,

Rand staff have catalogued and classified local government experience and problems in adopting these deployment methods.

Transfer of Emergency Service Deployment Models to Operating Agencies, J. M. Chaiken, *Management Science*, Vol. 24, March 1978.

P-5870, *Implementation of Emergency Service Deployment Models in Operating Agencies*, J. M. Chaiken, May 1977.

P-6035, *Transfer of Emergency Service Deployment Models to Operating Agencies*, J. M. Chaiken, October 1977.

P-6458, *Two Patrol Car Deployment Models: History of Use 1975-1979*, J. M. Chaiken, March 1980.

THE DEMOGRAPHIC STRUCTURE AND COMPOSITION OF POST-1970 NONMETROPOLITAN GROWTH

Department of Commerce (Economic Development Administration)

Term and Scale of Effort: 4/76 - 1/78; 2 person years

Principal Investigator: Peter A. Morrison

For the first time in this century, the nonmetropolitan population growth rate exceeds the metropolitan, and migrants are flowing from city to country. The revival of growth in nonmetropolitan areas, complicated by its diverse manifestations in specific locales, underscores the importance of timely information and analysis at the level of individual counties. Two sources of data made analysis at this level possible: (1) the 10 percent Social Security Sample covering the period 1971-73 and (2) the Census Bureau's migration tallies covering the period 1970-73. Rand staff used these new sources of data to analyze the demographic structure and composition of post-1970 trends in nonmetropolitan areas. The analysis gave the Economic Development Administration a firmer basis for distinguishing areas within its purview where assistance can be most effective in stimulating economic development, for assigning priorities among these areas, and for orchestrating the available development measures.

R-2399-EDA, *The Changing Demographic and Economic Structure of Nonmetropolitan Areas in the United States*, K. F. McCarthy and P. A. Morrison, January 1979; also in *International Regional Science Review*, 2(2), 1977.

Rural Renaissance in America? The Revival of Population Growth in Remote Areas, P. A. Morrison, Population Reference Bureau, Inc., Washington, D.C., October 1976.

P-6000, *Current Demographic Change in Regions of the United States*, P. A. Morrison, November 1977; condensed version in *American Demographics*, May 1979.

P-5873, *Emerging Public Concerns Over U.S. Population Movements in an Era of Slowing Growth*, P. A. Morrison, October 1977; also in T. Espenshade and W. Serow (eds.), *The Economic Consequences of Slowing Population Growth*, Academic Press, 1978.

P-5794, *New York State's Transition to Stability: The Demographic Outlook*, P. A. Morrison, January 1977; also in B. Chinitz (ed.), *The Declining of New York in the 1970s: A Demographic and Economic Analyses*, Praeger, 1978.

PUBLIC WORKS AS A COUNTERCYCLICAL DEVICE

Department of Commerce (Economic Development Administration)

Term and Scale of Effort: 7/75 - 10/76; 6.2 person years

Principal Investigator: Georges G. Vernez

Although the use of public works to stabilize the economy has declined since World War II, many economists, politicians, and others continue to believe that public works programs can be modified to stimulate employment during recessions. In this study, Rand developed policy guidelines designed to answer major questions concerning what types of public works should be implemented for countercyclical purposes, when in the business cycle they should be used, and where they could be used to greatest advantage.

R-1990-EDA, *Public Works as a Countercyclical Device: A Review of the Issues*, R. J. Vaughan, July 1976.

R-2052-EDA, *Regional Cycles and Employment Effects of Public Works Investments*, G. G. Vernez, R. J. Vaughan, B. K. Burright, and S. B. Coleman, January 1977.

EVALUATING THE SERVICES INTEGRATED TARGETS OF OPPORTUNITY PROGRAM

Department of Health and Human Services (Assistant Secretary for Planning and Evaluation)

Term and Scale of Effort: 1/75 - 7/75; 1 person year

Principal Investigator: William A. Lucas

The number, range, and complexity of public services have resulted in a complex and vast set of bureaucracies, creating waste and duplication in the agencies and leaving the potential service user confused as to what services are available and where. In this study, Rand developed a case survey method to be used to aggregate available reports, evaluation materials, and case studies on projects that have sought to coordinate the delivery of social ser-

vices. The central emphasis was on evaluating the Services Integrated Targets of Opportunity (SITO) program, a series of projects sponsored by HEW to test various approaches designed to coordinate public services.

THE USE OF NEW TECHNOLOGY TO DELIVER LOCAL SERVICES

National Science Foundation

Term and Scale of Effort: 12/74 - 5/76; 2 person years

Principal Investigator: Robert K. Yin

The use of technology to improve local services has been a major concern at all levels of government. The federal government has taken an especially active role in seeking ways of implementing new technology because so many of the service delivery problems (e.g., improving public education, increasing public safety, and maintaining sound housing and physical environments) appear to involve common technological needs. In this study, Rand collected, analyzed, and assessed case studies of technological innovations in local public services in order to identify key factors associated with successful implementation, and thereby be able to suggest appropriate courses for federal policies in stimulating future innovations.

Tinkering with the System: Technological Innovations in State and Local Services, R. K. Yin, K. A. Heald, and M. E. Vogel, D. C. Heath and Company, 1977.

THE IMPACT OF FEDERAL PROGRAMS ON URBAN AREAS

The Charles R. Kettering Foundation

Term and Scale of Effort: 11/74 - 7/77; 3 person years

Principal Investigators: Stephen M. Barro and Roger J. Vaughan

Since World War II, federal programs and policies have helped shape the development of American cities. Among the many federal activities that have had substantial urban impact, a relatively small number were established with explicit "urban" goals in mind. The effects of specifically targeted efforts such as urban renewal, public housing, and mass transit assistance have been minor compared with those of federal programs aimed at the nation in general, such as income maintenance and social service programs, public works programs and national defense and space programs. This project was designed to enhance existing capabilities for assessing the potential impact of federal programs and policies on urban areas, particularly those programs that are not specifically "urban" in character.

R-2206-KF/HEW, *The Urban Impacts of Federal Policies: Vol. 1, Overview*, R. J. Vaughan, A. H. Pascal, and M. Vaiana, August 1980.

R-2028-KF/HEW, *The Urban Impacts of Federal Policies: Vol. 2, Economic Development*, R. J. Vaughan, June 1977.

R-2114-KF/HEW, *The Urban Impact of Federal Policies: Vol. 3, Fiscal Conditions*, S. M. Barro, April 1978.

R-2205-KF/HEW, *The Urban Impacts of Federal Policies: Vol. 4, Population and Residential Location*, R. J. Vaughan and M. E. Vogel, May 1979.

ALTERNATIVES TO FEDERAL REVENUE SHARING

National Science Foundation

Term and Scale of Effort: 11/74 – 3/76; 3 person years

Principal Investigator: Stephen M. Barro

During the course of this research Rand developed alternative formulas to achieve stated federal revenue sharing goals, analyzed their distributional effects, and evaluated them in comparison with each other and with existing revenue sharing formulas. The work had three primary objectives: (1) to improve the match between the financial resources available to state and local governments and the service needs they are responsible for meeting, (2) to influence state-local behavior in federally desired directions, to encourage spending of revenue sharing funds for increased state-local services "national priority" programs, and to encourage state-local utilization of progressive taxes, and (3) to produce a distribution of revenue sharing funds that is politically acceptable, given the representation of the affected jurisdictions in decisionmaking bodies.

N-1591-NSF, *Equalization and Equity in General Revenue Sharing: An Analysis of Alternative Distribution Formulas*, S. M. Barro, October 1980.

THEORY OF RESIDENTIAL LOCATION

National Science Foundation

Term and Scale of Effort: 10/74 – 2/77; 2 person years

Principal Investigators: Bryan C. Ellickson and Peter A. Morrison

Research on residential location has often been pursued by sociologists, political scientists, and economists in a manner that reflects the theoretical and methodological biases of their separate disciplines. Economists view access to employment centers and age of the housing stock as the major factors that explain the location of residences in urban areas. Sociologists and politi-

cal scientists, on the other hand, see neighborhoods and political jurisdictions as the primary determinants of where people live. This research sought to develop and test a theory of residential location that recognizes the joint impact of these various factors.

R-2024-NSF, *Economic Analysis of Urban Housing Markets: A New Approach*, B. Ellickson, B. Fishman, and P. A. Morrison, July 1977.

SERVICE PRICING AND URBAN DEVELOPMENT

National Science Foundation

Term and Scale of Effort: 6/74 – 1 '76; 2.5 person years

Principal Investigator: Laurence A. Dougharty

The pricing of public services (sewer systems, streets, fire protection, etc.) has for the most part been seen as a means of collecting revenue, but prices for public services can also affect a number of aspects of community life. The level of prices set can aid or deter a local jurisdiction in attaining such objectives as controlling growth, curtailing leapfrog development, and reaching a fiscal surplus. Rand determined the relationship between the pricing of public services and various measures of urban development and performance in collaboration with Santa Clara County, California. The study also developed tools to aid local policymakers in evaluating pricing alternatives.

R-1878/1-NSF, *Municipal Service Pricing: Impact on Urban Development and Finance—Summary and Overview*, L. A. Dougharty, C. H. Chew, I. Kobashi, E. S. Rolph, G. C. Sumner, S. O. Tapella, J. Webb, and B. Zycher, November 1975.

R-1878/2-NSF, *Municipal Service Pricing: Impact on Fiscal Position*, L. A. Dougharty, S. O. Tapella, and G. C. Sumner, November 1975.

R-1878/3-NSF, *Municipal Service Pricing: Impact on the Growth of Residential Development*, B. Zycher, L. A. Dougharty, C. H. Chew, and I. Kobashi, November 1975.

R-1878/4-NSF, *Municipal Service Pricing: Impact on the Spatial Location of Residential Development*, D. M. de Ferranti, C. H. Chew, I. Kobashi, E. S. Rolph, and J. Webb, November 1975.

A NATIONAL CENTER FOR RURAL DEVELOPMENT

The Edna McConnell Clark Foundation through the Southern Regional Council

Term and Scale of Effort: 1/74 – 10/74; 1 person year

Principal Investigator: Peter A. Morrison

Rand conducted research on the nature, extent, causes, and social consequences of rural poverty to assist the Clark Foundation in evaluating the goals of a projected National Center for Rural Development.

R-1651-CF, *Review of Federal Programs to Alleviate Rural Deprivation*, P. A. Morrison, S. M. Mazie, R. B. Rainey, Jr., S. Purnell, H. J. Boissevain, and S. B. Coleman, December 1974.

CITIZEN PARTICIPATION IN MUNICIPAL SERVICES: IMPROVING THE SERVICE-CLIENT RELATIONSHIP

National Science Foundation

Term and Scale of Effort: 9/73 – 10/74; 2 person years

Principal Investigator: Robert K. Yin

The growth of cities over the past 20 years, accompanied in many instances by a deterioration in urban life, has weakened the critical link between municipal government and citizen. Municipal agencies have appeared to be unresponsive to citizens' needs, inaccessible to the ordinary citizen, and their services subject to inordinate bureaucratic delays; citizens have appeared to be less appreciative of well-intentioned municipal programs, and in some instances have abused municipal employees and facilities. Rand reviewed more than 250 case studies of attempts to improve neighborhood services through decentralization, such as local school board elections, neighborhood health centers, team policing, community development corporations, and little city halls.

Street-Level Governments: Assessing Decentralization and Urban Services, R. K. Yin, and D. T. Yates, Jr., D. C. Heath and Company, 1975.

INNOVATION IN URBAN PUBLIC SERVICES

National Science Foundation

Term and Scale of Effort: 9/73 – 5/74; .3 person years

Principal Investigator: Robert K. Yin

Rand explored the factors that may be critical for improving public services through a review of ten cases of attempted innovation: in New York

City, a police "Fourth Platoon," water pollution control, "slippery water" for fire fighting, program budgeting, and medical processing for alcoholics; mechanization of trash collection and private provision of fire protection in Scottsdale, Arizona; transit pool dispatching and computer-based court scheduling in Tacoma, Washington; and a computerized housing finance analysis in New Jersey.

PROJECTS IN SYSTEMATIC ANALYSIS OF URBAN POLICY

National Science Foundation

Term and Scale of Effort: 7/71 - 11/73; 20 person years

Principal Investigator: Robert A. Levine

Rand sought to develop information for federal, state, and local policymakers to use in evaluating policies designed to alleviate what has been called the crisis of the cities. Through analyses of (1) San Jose, California, (2) Seattle, Washington, and (3) St. Louis, Missouri, Rand addressed three problems in particular: patterns of growth in urban areas, the jumble of political jurisdictions often hampering efforts to solve area problems, and the erosion of economic and social vitality in the historic central city. Policymakers in each of the three cities received suggestions for dealing with their current and anticipated problems. On the national level, this research was central to the revision of the urban policy statement issued by the National League of Cities/U.S. Conference of Mayors.

R-1225-NSF, *Decisionmaking by Residential Developers in Santa Clara County*, E. S. Rolph, August 1973.

R-1227-NSF, *Citizen Preference for Home, Neighborhood, and City in Santa Clara County*, F. Christen, October 1973.

R-1235-NSF, *Growth in San Jose: A Summary Policy Statement*, D. J. Alesch and R. A. Levine, May 1973.

R-1245-NSF, *Design for an Urban Services Resource/Cost Model*, G. C. Sumner and A. W. Bonner, June 1973.

R-1246-NSF, *A Classification of Large American Urban Areas*, E. B. Keeler, W. H. Rogers, May 1973.

R-1262-NSF, *The Design and Implementation of Economic Surveys: Response to a Recession in Seattle (1970-72)*, S. Crocker, June 1973.

R-1313-NSF, *San Jose and St. Louis in the 1960s: A Case Study of Changing Urban Populations*, P. A. Morrison, October 1973; also in S. Goldstein and D. Sly (eds.), *Patterns of Urbanization: Comparative Country Studies*, International Union for Scientific Study of Population, Liege, Belgium, 1977.

R-1329-NSF, *A Distributed Lag Model of Employment Levels in Seattle*, D. A. Relles and L. A. Day, September 1973.

R-1352-NSF, *Seattle's Adaptation to Recession*, R. B. Rainey, Jr., K. Anna, A. W. Bonner, S. Crocker, L. A. Day, B. J. Hawkins, N. J. King, R. A. Levine and D. A. Relles, September 1973.

R-1353-NSF, *St. Louis: A City and Its Suburbs*, B. R. Williams, August 1973.

R-1373-NSF, *Small-Area Population Estimates for the City of St. Louis, 1960-1972, with a Model for Updating Them*, P. A. Morrison and D. A. Relles, September 1973; reprinted as "A Method for Monitoring Small-Area Population Changes in Cities," *Review of Public Data Use*, April 1975.

R-1419-NSF, *Growth Control: Some Questions for Urban Decisionmakers*, R. A. Levine, July 1974.

"The Functions and Dynamics of the Migration Process" (Chap. 4) and "Urban Growth and Decline in the U.S.: A Study of Migration's Effects in Two Cities" (Chap. 14), P. A. Morrison, in A. Brown and E. Neuberger (eds.), *Internal Migration: A Comparative Perspective*, Academic Press, 1977.

"Urban Growth and Decline: San Jose and St. Louis in the 1960s," P. A. Morrison, *Science*, August 1974.

"A Demographic Assessment of New Cities and Growth Centers as Population Redistribution Strategies," P. A. Morrison, *Public Policy*, Summer 1973.

P-5514, *The Current Demographic Context of National Growth and Development*, P. A. Morrison, September 1975 (testimony before House Subcommitte on Housing and Community Development); condensed version (Chap. 6.6) in L. S. Bourne and J. W. Simmons (eds.), *Systems of Cities*, Oxford University Press, 1978.

FEDERAL-STATE-LOCAL FISCAL RELATIONS

The Ford Foundation

Term and Scale of Effort: 2/69 – 2/73; 6 person years

Principal Investigator: Stephen M. Barro

Rand assessed the fiscal impact of federal grants-in-aid to states and state grants to localities in three major areas: elementary and secondary education, income maintenance (welfare), and highways. In each area, the project staff developed econometric models of determinants of state or local spending, relating expenditure levels to economic and demographic characteristics of localities and to the level and form of intergovernmental aid. The models were

used to estimate effects of alternative aid formulas on spending and taxing by the aid recipients. In the education area, Rand also examined alternative designs for school finance systems, especially in connection with then-current proposals for federal general-purpose aid and state-level school finance reform.

R-807-FF, *A Method for Predicting the Effects of Different Forms of Outside Aid on Local Educational Expenditure*, E. O. Olsen, December 1972.

R-867-FF, *Theoretical Models of School District Expenditure Determination and the Impact of Grants-In-Aid*, S. M. Barro, February 1972.

R-894-FF, *The Impact of Grants-in-Aid on State Income Maintenance Decisions*, F. A. Sloan, February 1972.

R-1153-FF, *Policy Simulations on a Model of State Income Maintenance Decisions*, F. A. Sloan and D. P. Schneider, February 1973.

R-1233-FF, *The Response of State Highway Expenditures and Revenues to Federal Grants-in-Aid*, J. H. Enns, February 1974.

OTHER DOMESTIC RESEARCH PROJECTS

In addition to research undertaken in the preceding programs, Rand engages in applied and basic research in a variety of broad areas of concern that include communications, climate, space, transportation and the environment, water management, and work on supporting science, technology, and methodology.

WATER MODELING

HYDRODYNAMIC MODELING

Netherlands Rijkswaterstaat

Term and Scale of Effort: 4/72 – 4/81; 34.0 person years

Principal Investigator: Jan J. Leendertse

In 1964, Rand initiated the development of a computer model simulating long-period waves to be used for applied research on coastal waters. Over a three-year period, Rand and the Netherlands Rijkswaterstaat investigated the application of the model to the Haringvliet (the mouth of the Rhine River), to tidal movements in the southern part of the North Sea, and to the shallow coastal shelf near the southwestern coast of the Netherlands. Extending this research, Rand developed a model for the quantitative assessment of technical alternatives in managing waste discharges and for assessing the effects of engineering construction in well-mixed estuaries and coastal seas. Staff are now working on a three-dimensional model of tidal flow, salinity, and pollution in estuaries and coastal seas. This family of computational models is to be used by government agencies in solving practical problems in water resources management.

MODELING OF TIDES AND CIRCULATIONS OF THE BERING SEA

National Oceanic and Atmospheric Administration

Term and Scale of Effort: 9/76 – 1/81; 5 person years

Principal Investigators: Jan J. Leendertse and S. K. Liu

Rand is developing a three-dimensional mathematical model of the tides and circulation of the Eastern Bering Sea to determine the nature and effectiveness of the physical processes transporting pollutants in these waters. The model is intended to be used in the planning stages of offshore petroleum development to minimize potential environmental risk, to assist in the formulation of countermeasures in the event of an oil spill or the introduction of other contaminants, and to provide information for planning the location of long-term environmental monitoring stations.

R-2405-NOAA, *A Three-Dimensional Model for Estuaries and Coastal Seas: Vol. VI, Bristol Bay Simulations*, S. K. Liu and J. J. Leendertse, September 1979.

SIMULATING WATER FLOWS

Department of the Interior (Geological Survey)

Term and Scale of Effort: 11/71 - 8/78; 7 person years

Principal Investigator: Jan J. Leendertse

Rand assisted the United States Geological Survey in exploring the hydrodynamics of multi-space, multi-dimensional transient flows in waterways and water bodies. This study was part of an ongoing research project on the development of mathematical simulations of water flows and water quality parameters that can be used in the planning and management of waterway and estuary modifications.

R-2298-RC, *A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. IX, The Computer Program*, J. J. Leendertse and A. B. Nelson, April 1978.

A THREE-DIMENSIONAL FINITE DIFFERENCE MODEL FOR ESTUARIES

Department of the Interior (Office of Water Resources Research)

Term and Scale of Effort: 9/72 - 7/77; 4.2 person years

Principal Investigator: Jan J. Leendertse

In the first two phases of this research, Rand developed a computational model for simulating three-dimensional transient flows and water-quality parameters (including temperature) in waterways and waterbodies with nonisotropic densities. Previously, only two-dimensional numerical models, which fit only a limited number of cases, and physical models that could not satisfy all the scaling laws were available. The model can be used for water resources development and water quality management in such projects as dredging, landfilling, constructing hurricane barriers, and assessing the impact of powerplant waste heat on temperature distribution in lakes and estuaries.

R-1417-OWRR, *A Three-Dimensional Model for Estuaries and Coastal Seas: Vol. I, Principles of Computation*, J. J. Leendertse, R. C. Alexander, and S. K. Liu, December 1973.

R-1764-OWRT, *A Three-Dimensional Model for Estuaries and Coastal Seas: Vol. II, Aspects of Computation*, J. J. Leendertse and S. K. Liu, June 1975.

R-1884-OWRT, *A Three-Dimensional Model for Estuaries and Coastal Seas: Vol. III, The Interim Program*, J. J. Leendertse, S. K. Liu, and A. B. Nelson, October 1975.

R-2187-OWRT, *A Three-Dimensional Model for Estuaries and Coastal Seas: Vol. IV, Turbulent Energy Computation*. J. J. Leendertse and S. K. Liu, May 1977.

R-2188-OWRT, *A Three-Dimensional Model for Estuaries and Coastal Seas: Vol. V, Turbulent Energy Program*, S. K. Liu and A. B. Nelson, May 1977.

SHORT COURSE IN ESTUARINE MODELING WITH THE SIMSYS2D SYSTEM

Department of the Interior (Geological Survey)

Term and Scale of Effort: 6/77 – 6/78; 1.6 person years

Principal Investigator: Jan J. Leendertse

A large computer simulation system for the modeling of estuaries and coastal seas was developed at Rand under sponsorship of the United States Geological Survey and the Netherlands Rijkswaterstaat. This system permits modeling of fluid flow and transport of dissolved substances in very complicated water bodies. Its design permits easy experimentation, and the results can be graphically compared with field data. The graphic representations are easily adapted to agency reports. During the summer of 1978 Rand model developers instructed USGS personnel in its use. Participants with experience with one-dimensional models were instructed how to use the two-dimensional modeling system.

WATER MANAGEMENT

A STUDY OF WATER MANAGEMENT STRATEGIES IN THE NETHERLANDS

Netherlands Rijkswaterstaat

Term and Scale of Effort: 8/76 – 10/81; 47.6 person years

Principal Investigator: Bruce F. Goeller

In the Netherlands, the future demand for fresh water is expected to exceed the supply. Already there is a problem with water quality, particularly eutrophication and thermal pollution. The Dutch government wanted an analysis to help draft the first national water management law, as well as a new groundwater control act, and to select the overall water management policy for the Netherlands. With the Netherlands Rijkswaterstaat, Rand has conducted a joint study to develop alternative water management policies for the Netherlands and to assess and compare the diverse consequences of these policies. The policies developed consider both the short and the long term and include building new facilities, changing the distribution of water through a

fixed set of facilities by means of managerial measures, and using price or regulation to affect the quantity or quality of water extracted or discharged by the different users. Rand is curently documenting the methodology and results of the study. Much of the methodology has already been transferred to the Netherlands, where Dutch analysts, trained by Rand, are using it to extend the joint analysis and to analyze other regional and local water management problems.

PROTECTING AN ESTUARY FROM FLOODS: A POLICY ANALYSIS OF THE OOSTERSCHELDE

Netherlands Rijkswaterstaat

Term and Scale of Effort: 4/75 - 4/77; 20 person years

Principal Investigator: Bruce F. Goeller

In February 1953, a severe storm flooded much of the Delta Region of Holland, killing several thousand people. After that disaster, the Dutch government decided to increase greatly the protection from flooding for all Delta estuaries. By 1975, all the estuaries had been protected except the largest, the Oosterschelde. For the Oosterschelde, the choice among alternative means of protection seemed almost overwhelmingly difficult because the alternatives were complex and their consequences difficult to predict—particularly regarding security from flooding and ecological changes. Other consequences considered included investment costs, effects on the fishing industry, recreational opportunities, and employment.

The POLANO (Policy Analysis of the Oosterschelde) project was founded as a joint research project of Rand and the Netherlands Rijkswaterstaat (Ministry of Public Works) in April 1975 to help the Dutch government analyze the alternatives for protecting the Oosterschelde. Rand's main task was to help the Dutch develop and apply a methodological framework for predicting and comparing the different consequences of these alternatives. A major innovation was the creation of a mathematical model to predict long-run changes in the marine ecology. Based on a Dutch language summary of the results of the Rand/Rijkswaterstaat analysis, the Dutch Cabinet recommended a particular alternative to Parliament, which approved it in late June 1976.

R-2121/1-NETH, *Protecting an Estuary from Floods—A Policy Analysis of the Oosterschelde: Vol. I, Summary Report*, B. F. Goeller et al., December 1977.

R-2121/2-NETH, *Protecting an Estuary From Floods—A Policy Analysis of the Oosterschelde: Vol. II, Assessment of Security from Flooding*, A. F. Abrahamse et al., April 1977.

R-2121/3-NETH, *Protecting an Estuary from Floods—A Policy Analysis of the Oosterschelde: Vol. III, Assessment of Long-Run Ecological Balances*, J. H. Bigelow et al., April 1977.

R-2121/3A-NETH, *Protecting An Estuary from Floods—A Policy Analysis of the Oosterschelde: Vol. III, Assessment of Long-Run Ecological Balances: An Addendum (Calibration Data)*, J. H. Bigelow and C. Dzitzer, February 1978.

R-2121/4-NETH, *Protecting an Estuary from Floods—A Policy Analysis of the Oosterschelde: Vol. IV, Assessment of Algae Blooms, a Potential Ecological Disturbance*, J. H. Bigelow, J. G. Bolten, and J. C. De Haven, April 1977.

R-2121/5-NETH, *Protecting an Estuary from Floods—A Policy Analysis of the Oosterschelde: Vol. V, Anaerobic Conditions and Related Ecological Disturbances*, J. H. Bigelow and J. C. De Haven, April 1977.

R-2121/6-NETH, *Protecting an Estuary From Floods—A Policy Analysis of the Oosterschelde: Vol. VI, Selected Social and Economic Aspects*, D. M. de Ferranti, F. J. P. Heuer, and J. W. Weehuizen, July 1977.

PROTECTING AN ESTUARY FROM FLOODS: AN ANALYSIS OF BARRIER CONTROL STRATEGIES FOR THE OOSTERSCHELDE

Netherlands Rijkswaterstaat

Term and Scale of Effort: 4/77 - 1/80; 10.4 person years

Principal Investigator: Bruce F. Goeller

The system for flood protection approved by the Dutch Parliament is a complex storm-surge barrier, consisting of about 60 gates, a dike system, and a control system employing sensing devices and computers to regulate the opening and closing of the gates. The barrier was to be a flow-through dam whose gates would be open in nonstormy weather and would be closed against high water levels that occur in the North Sea during severe winter storms.

Rand's efforts were directed toward designing the preferred control strategy for operating the barrier—one that would provide the most desirable combination of security from flooding and preservation of the ecology. Rand's other tasks included providing education and training in policy analysis techniques for persons appointed by the Netherlands Government, and assisting in the development of a water basin model to predict ecological changes resulting from substances entering the basin from the surrounding environment.

R-2444/1-NETH, *Controlling the Oosterschelde Storm-Surge Barrier—A Policy Analysis of Alternative Strategies, Vol. I, Summary Report*, L. Catlett, S. Wildhorn, R. Stanton, A. Roos, and J. Al, September 1979.

R-2444/2-NETH, *Controlling the Oosterschelde Storm-Surge Barrier—A Policy Analysis of Alternative Strategies, Vol. II, Sensitivity Analysis*, S. Wildhorn and R. Stanton, September 1979.

R-2444/3-NETH, *Controlling the Oosterschelde Storm-Surge Barrier—A Policy Analysis of Alternative Strategies, Vol. III, Predicting North Sea Water Levels*, L. Catlett and G. Hall, Jr., September 1979.

R-2444/4-NETH, *Controlling the Oosterschelde Storm-Surge Barrier—A Policy Analysis of Alternative Strategies, Vol. IV, Basin Response to North Sea Water Levels: The Barcon Simplic Model*, L. Catlett, R. Stanton, and O. Yildez, September 1979.

ANTARCTIC ICEBERGS AS A GLOBAL FRESH WATER RESOURCE

National Science Foundation

Term and Scale of Effort: 6/72 - 2/74; 2 person years

Principal Investigator: John L. Hult

Rand investigated the feasibility of moving Antarctic icebergs to offshore locations in water-poor areas, where they would be melted under controlled conditions to supply fresh water. The crucial problem in this research was to devise a technology that could deliver melted iceberg water at much lower cost than either desalting or interbasin transfers, while at the same time ensuring that the environmental impact of such operations would be acceptable.

R-1255-NSF, *Antarctic Icebergs as a Global Fresh Water Resource*, J. L. Hult and N. C. Ostrander, October 1973.

R-1354-NASA/NSF, *Applicability of ERTS for Surveying Antarctic Iceberg Resources*, J. L. Hult and N. C. Ostrander, November 1973.

COMMUNICATIONS POLICY

CONSULTING ASSISTANCE—CABLE TELEVISION

Federal Communications Commission

Term and Scale of Effort: 1/77 - 9/80; 1.1 person years

Principal Investigator: Rolla E. Park

The Federal Communications Commission's Inquiry into the economic relationship between television broadcasting and cable television sought information to guide the Commission's continuing reevaluation of its cable television regulations. One of the central questions in the inquiry is: How

much audience is diverted from local TV stations by cable systems carrying distant signals? This study provided some answers, based on a statistical analysis of new data assembled by the FCC's Cable Bureau. The results suggest that television broadcasting will continue to prosper, despite increasing competition from cable systems.

R-2403-FCC, *Audience Diversion Due to Cable Television: A Statistical Analysis of New Data*, R. E. Park, April 1979.

R-2403/1-FCC, *Audience Diversion Due to Cable Television: Supporting Data*, R. E. Park, April 1979.

N-1334-FCC, *Audience Diversion Due to Cable Television: Response to Industry Comments*, R. E. Park, November 1979.

N-1334/1-FCC, *Audience Diversion Due to Cable Television: Data for Response to Industry Comments*, R. E. Park, November 1979.

P-6399, *Audience Diversion Due to Cable Television: An Application of Nonlinear, Nondiagonally Weighted, Generalized Least Squares*, R. E. Park, March 1980.

CONSULTING ASSISTANCE--NETWORK INQUIRY

Federal Communications Commission

Term and Scale of Effort: 1/80 - 9/80; .4 person years

Principal Investigator: Rolla E. Park

To assist the FCC's Network Inquiry, an earlier Rand report on the prospects for new television networks was updated using more recent data. The report concludes that a fourth TV network would suffer from coverage and UHF handicaps relative to the existing networks. However, as the number of UHF stations increases, the UHF handicap falls, cable penetration increases, and advertising revenues rise, there may be renewed interest in forming a fourth TV network.

N-1526-FCC, *New Television Networks: An Update*, R. E. Park, August 1980.

REGULATORY LAG EXPERIMENTATION

National Bureau of Standards (DOC)

Term and Scale of Effort: 3/77 - 8/77; .2 person years

Principal Investigator: Leland L. Johnson

Rand conducted a survey of published literature concerned with the causes and proposed reforms of regulatory lag at the federal and state level,

with respect to the electric power and telephone industries. The work was designed to assist the Experimental Technology Incentives Program in its efforts to reduce regulatory lag and to plan experiments or other activities in the area of regulatory policy.

TESTING A MODEL FOR ISOLATING MEDIA AND CONTEXTUAL EFFECTS

National Science Foundation

Term and Scale of Effort: 6/76 – 11/77; 1 person year

Principal Investigator: William A. Lucas

There is substantial evidence that the political awareness and orientation of a community are shaped by the range of news media available—with or without local television, with or without a local daily newspaper. Rand investigated how different media environments affect citizen knowledge of local, state, and national politics by conducting interviews in seven cities in the Pittsburgh area. Research results were incorporated in a model of political learning to test several conventional assumptions about the effects of television news that are often central to the regulatory policy established by the Federal Communications Commission.

R-2135-NSF, *An Assessment of Telephone Survey Methods*, W. A. Lucas and W. C. Adams, October 1977.

COMMUNICATIONS POLICY ISSUES

The John and Mary R. Markle Foundation

Term and Scale of Effort: 7/70 – 4/77; 14 person years

Principal Investigator: Leland L. Johnson

In a few decades, electronics and space sciences have provided the means to expand many times over the capacity to entertain, educate, and inform, not only around the globe but through outer space as well. This general program support grant has enabled Rand to explore major issues concerning the future development and economics of the broadcasting industry. Research under this program initially emphasized the impact of cable on television broadcasting; subsequently, Rand investigated the effects of television on human behavior, the license renewal process in radio and television broadcasting, the effects of competition in the television industry, the pricing of telephone services, and copyright problems in television.

R-587-FF/MF, *Potential Impact of Cable Growth on Television Broadcasting*, R. E. Park, October 1970.

R-595-MF, *Cable Television and the Question of Protecting Local Broadcasting*, L. L. Johnson, October 1970.

R-689-MF, *Cable Television and UHF Broadcasting*, R. E. Park, January 1971.

R-783-MF, *State Regulation of Cable Television*, M. R. Mitchell, October 1971.

R-828-MF, *Cable Television and Higher Education: Two Contrasting Experiences*, L. L. Johnson, September 1971.

R-875-MF, *Prospects for Cable in the 100 Largest Television Markets*, R. E. Park, October 1971.

R-881-MF, *Access by Local Political Candidates to Cable Television: A Report of an Experiment*, H. S Dordick and J. Lyle, November 1971.

R-888-MF, *Interactive Television—Prospects for Two-Way Services on Cable*, W. S. Baer, November 1971.

R-1027-MF, *Computer Code for a Cable Television System Financial Model*, R. E. Park, April 1972.

R-1057-FF/MF, *The Exclusivity Provisions of the Federal Communications Commission's Cable Television Regulations*, R. E. Park, June 1972.

R-1089-USOE/MF, *Three Models for Home-Based Instructional Systems Using Television*, R. Bretz, October 1972.

R-1328-MF, *The Value of Television Time and the Prospects for New Stations*, S. M. Besen, October 1973.

R-1345-MF, *Serving Local Needs with Telecommunications: Alternative Applications for Public Services*, W. A. Lucas and R. K. Yin, November 1973.

R-1398-MF, *Economic Analysis and Television Regulation: A Review*, S. M. Besen and B. M. Mitchell, December 1973.

R-1408-MF, *New Television Networks*, R. E. Park, December 1973.

R-1585-MF, *Newspaper-Television Station Cross-Ownership: Options for Federal Action*, W. S. Baer, H. Geller, and J. A. Grundfest, September 1974.

R-1677-MF, *Expanding the Use of Commercial and Noncommercial Broadcast Programming on Cable Television Systems*, L. L. Johnson, January 1975.

R-1712-MF, *Watergate and Television: An Economic Analysis*, S. M. Besen and B. M. Mitchell, May 1975.

R-1858-MF, *Television News and Local Awareness: A Retrospective Look*, W. A. Lucas and K. B. Possner, October 1975.

R-1896-MF, *Citizen Participation in Broadcast Licensing before the FCC*, J. A. Grundfest, March 1976.

R-1962-MF, *Optimal Pricing of Local Telephone Service*, B. M. Mitchell, November 1976.

R-2023-MF, *Copyright Liability for Cable Television: Is Compulsory Licensing the Solution?*, S. M. Besen, W. G. Manning, Jr., and B. M. Mitchell, February 1977.

Handbook for Producing Educational and Public-Access Programs for Cable Television, R. Bretz, Educational Technology Publications, 1976.

PRICING OF LOCAL RESIDENTIAL TELEPHONE SERVICE

National Science Foundation

Term and Scale of Effort: 9/77 – 4/83; 7.2 person years

Principal Investigator: Bridger M. Mitchell

For many years, local telephone calls in the United States have been supplied for a flat monthly fee, regardless of how the service is used. Telephone companies and regulatory commissions are considering fundamental changes that would place most residential telephone services on a "pay-as-you-use" basis. Usage-sensitive pricing (USP) would eventually allow charges to be based on the number, duration, distance, and time of day of every local call. This project examines the major distributive and allocative effects of widespread introduction of USP. The research objectives include: determining how USP will affect various groups (such as low-income, minority, and aged); measuring the reduction in use and the shift in time of day at which calls are made; estimating the cost savings that both telephone companies and their customers may achieve by USP; and analyzing the overall costs and benefits of new pricing plans.

R-2535-NSF, *Charging for Local Telephone Calls: How Household Characteristics Affect the Number of Calls in the GTE Illinois Experiment*, R. E. Park, B. M. Mitchell, B. M. Wetzel, and J. H. Alleman, forthcoming.

R-2635-NSF, *Charging for Local Telephone Calls: Price Elasticity Estimates from the GTE Illinois Experiment*, R. E. Park and B. M. Wetzel, forthcoming.

"Optimal Pricing of Local Telephone Service," B. M. Mitchell, *American Economic Review*, September 1978.

"Demographic Effects of Local Calling Under Measured vs. Flat Rate Service: Analysis of Data from the GTE Illinois Experiment," R. E. Park, B. M. Mitchell, and B. M. Wetzel, *Pacific Telecommunications Conference Proceedings*, Pacific Telecommunications Conference '80, Honolulu, 1980.

"The Effect on Residential Telephone Use of Charging for Local Calls: Initial Analysis of Data from the GTE Illinois Experiment," R. E. Park, B. M. Mitchell, and J. H. Alleman, *Proceedings of the Seventh Annual Telecommunications Policy Research Conference*, forthcoming.

P-6078, *Specifying and Estimating Multi-Product Cost Functions for a Regulated Telephone Company*, B. M. Mitchell, forthcoming; also in G. Fromm (ed.), *Studies in Public Regulation*, MIT Press, forthcoming.

P-6169, *Pricing Policies in Selected European Telephone Systems*, B. M. Mitchell, July 1978; also in H. Dordick (ed.), *Proceedings of the Sixth Annual Telecommunications Policy Research Conference*, Lexington Books, 1979.

P-6322, *Economic Issues in Local Measured Service*, J. A. Baruk, March 1979; also in J. A. Baruk (ed.), *Perspectives on Local Measured Service*, Telecommunications Workshop Organizing Committee, 1979.

P-6321, *Economic Aspects of Measured-Service Telephone Pricing*, B. M. Mitchell, March 1979; also in *Fifth Annual Symposium on Ratemaking Problems of Regulated Industries*, University of Missouri, 1979.

P-6495, *Alternative Measured-Service Rate Structures for Local Telephone Service*, B. M. Mitchell, June 1980; also in M. A. Crew (ed.), *Issues in Public Utility Pricing and Regulation*, Lexington Books, forthcoming.

P-6215, *Telephone Call Pricing in Europe: Localizing the Pulse*, B. M. Mitchell, January 1979; also in J. T. Wenders (ed.), *Pricing in Regulated Industries: II*, Mountain States Telephone and Telegraph Co., 1979.

P-6530, *Economic Issues in Usage-Sensitive Pricing*, B. M. Mitchell September 1980.

USING CABLE TELEVISION TO DELIVER PUBLIC SERVICES IN SPARTANBURG

National Science Foundation

Term and Scale of Effort: 6/74 - 7/78; 14.4 person years

Principal Investigator: William A. Lucas

For years, the development of two-way cable television promised dramatic social impact. Two-way or interactive television, allowing the home viewer to send as well as receive messages over his TV set and home terminal, was expected to provide a variety of social services to the home. Today, the use of cable TV stands in sharp contrast to this potential. The high costs of capital, the overextension of many cable operators, and modest subscriber rates have raised questions about the potential social and economic benefits of cable. Spartanburg, South Carolina, offered an ideal site to study the possible social benefits of cable because of the technical capacity of the city's cable system. Rand, TeleCable Corporation, and state and local agencies in South Carolina designed and tested three experimental applications of cable TV: adult education, the training of day care center operators, and participation in senior citizen centers. Separately, each application constituted a comparative study of alternative approaches to a specific service delivery problem. Two-way

cable was compared with the use of one-way cable, conventional classroom learning, and client and personnel time in the delivery of social services.

R-2270-NSF, *Cable, Two-Way Video, and Educational Programming: The Case of Day Care*, S. E. Berryman, T. K. Bikson, and J. Bazemore, October 1978.

R-2271-NSF, *The Spartanburg Interactive Cable Experiments in Home Education*, W. A. Lucas, K. A. Heald, and J. Bazemore, February 1979.

SOCIAL EFFECTS OF TELEVISION VIEWING

The Edna McConnell Clark Foundation

Term and Scale of Effort: 10/73 – 7/75; 2 person years

Principal Investigator: George A. Comstock

Home television sets are turned on for an average of six hours a day. Many questions arise about the effect of this pervasive force on individuals and society in general: Does it make children more social or less social? How does it affect attitudes toward violence, drugs, race relations? Does it have educational value? Has it taken over from the home, the school, and the church the role of communicating norms, values, and modes of behavior? Rand evaluated and synthesized the available scientific evidence of television's effects on society to see whether it is adequate to guide policy or action by government, industry, and consumer groups.

R-1746-CF, *Television and Human Behavior: A Guide to the Pertinent Scientific Literature*, G. A. Comstock and M. L. Fisher, June 1975.

R-1747-CF, *Television and Human Behavior: The Key Studies*, G. A. Comstock, F. Christen, M. L. Fisher, R. C. Quarles, and W. D. Richards, June 1975.

R-1748-CF, *Television and Human Behavior: The Research Horizon, Future and Present*, G. A. Comstock, G. Lindsey, and M. L. Fisher, June 1975.

Television and Human Behavior, G. A. Comstock, S. Chafee, N. Katzman, M. McCombs, and D. Roberts, Columbia University Press, forthcoming.

THE WORKSHOP AND THE WORLD: TOWARD AN ASSESSMENT OF THE CHILDREN'S TELEVISION WORKSHOP

The John and Mary R. Markle Foundation

Term and Scale of Effort: 6/73 – 11/73; .2 person years

Principal Investigator: Robert K. Yin

The impact of television on children's lives has been a topic of continuing concern to educators, media specialists, and the public; but only a few pro-

grams expressly intended to improve the quality of children's lives have been developed. Of these, two of the most important were produced by the Children's Television Workshop—"Sesame Street" and "The Electric Company." In cooperation with the Children's Television Workshop, Rand explored the feasibility of assessing the social and policy significance of these programs.

R-1400-MF, *The Workshop and the World: Toward an Assessment of the Children's Television Workshop*, R. K. Yin, October 1973.

PUBLIC TELEVISION AND SPECIAL AUDIENCE INTERESTS

The John and Mary R. Markle Foundation

Term and Scale of Effort: 7/74 – 11/74; .5 person year

Principal Investigator: Robert K. Yin

One view of public television says that, whether for education or entertainment, its role is to cater to specialized audience interests, in contrast to the mass appeal strategy pursued by commercial television. Rand studied possible ways of determining the nature and size of such special audiences.

TELECOMMUNICATIONS POLICY

The Ford Foundation

Term and Scale of Effort: 6/73 – 6/75; 3 person years

Principal Investigator: Leland L. Johnson

Rand explored a number of issues in mass communications, including the Fairness Doctrine, regulation of cable television, reform of the Federal Communications Commission, and the broadcast station license renewal process. In addition, staff members presented oral arguments before the FCC on restrictions concerning cable television.

R-1412-FF, *The Fairness Doctrine in Broadcasting: Problems and Suggested Courses of Action*, H. Geller, December 1973.

R-1548-FF, *The Mandatory Origination Requirement for Cable Systems*, H. Geller, August 1974.

FUTURE TELEVISION SPECTRUM REQUIREMENTS

Federal Communications Commission

Term and Scale of Effort: 6/73 – 3/76; 3 person years

Principal Investigator: Rolla E. Park

The next 15-year period is likely to bring substantial changes in communications technology. The expansion of cable television, the development of new networks, the use of satellites for network interconnection, the beginning of pay television, and the development of a well-financed system of noncommercial broadcasting are all near-term prospects. Rand evaluated the potential impact of these developments on the economic structure and performance of the over-the-air broadcasting industry so that future demands on the radio frequency spectrum could be anticipated.

R-1841-FCC *Projecting the Growth of Television Broadcasting: Implications for Spectrum Use*, R. E. Park, L. L. Johnson, and B. Fishman, February 1976.

CONCENTRATION OF OWNERSHIP AND CONTROL IN MASS COMMUNICATIONS: ASSESSING THE STATE OF CURRENT KNOWLEDGE

National Science Foundation

Term and Scale of Effort: 4/73 – 9/74; 2 person years

Principal Investigator: Walter S. Baer

Rand assessed the range of research dealing with media ownership and control to determine its relevance in guiding government policy. By bringing together evidence from a wide variety of sources, the project staff sought to identify gaps in present knowledge and suggest additional analysis that might strengthen the basis for policymaking in the future.

R-1584-NSF, *Concentration of Mass Media Ownership: Assessing the State of Current Knowledge*, W. S. Baer, H. Geller, J. A. Grundfest, and K. B. Possner, September 1974.

THE FRANCHISING AND DEVELOPMENT OF BROADBAND CABLE COMMUNICATIONS

National Science Foundation

Term and Scale of Effort: 12/71 – 4/73; 3.8 person years

Principal Investigator: Walter S. Baer

The development of cable television demands more decisionmaking by local communities than most technologies have required in the past. The

series of reports produced in this project is designed to help communities make informed and responsible choices in awarding franchises and planning programming and services. The reports constitute a guide to the political, social, economic, legal, and technological issues associated with cable television.

R-1134-NSF, *Cable Television: A Summary Overview for Local Decisionmaking*, W. S. Baer, February 1973.

R-1135-NSF, *Cable Television: The Process of Franchising*, L. L. Johnson and M. Botein, March 1973.

R-1136-NSF, *Cable Television: Citizen Participation in Planning*, R. K. Yin, March 1973.

R-1137-NSF, *Cable Television: Technical Considerations in Franchising Major Market Systems*, C. Pilnick, April 1973.

R-1139-NSF, *Cable Television: Citizen Participation after the Franchise*, M. E. Price and M. Botein, April 1973.

R-1140-NSF, *Cable Television: Applications for Municipal Services*, R. K. Yin, May 1973.

R-1141-NSF, *Cable Television: A Guide to the Technology*, C. Pilnick and W. S. Baer, June 1973.

R-1142-NSF, *Cable Television: Making Public Access Effective*, R. C. Kletter, May 1973.

R-1143-NSF, *Cable Television: Uses in Education*, M. B. Carpenter, May 1973.

R-1144-NSF, *Cable Television: A Guide for Education Planners*, M. B. Carpenter, May 1973.

Cable Television: A Handbook for Decisionmaking, W. S. Baer, Crane, Russak & Company, Inc., 1974.

Cable Television: Franchising Considerations, W. S. Baer, M. Botein, L. L. Johnson, C. Pilnick, M. E. Price, and R. K. Yin, Crane, Russak & Company, Inc., 1974.

Cable Television: Developing Community Services, M. B. Carpenter-Huffman, R. C. Kletter, and R. K. Yin, Crane, Russak & Company, Inc., 1974.

Cable Television: A Guide to Federal Regulations, S. R. Rivkin, Crane, Russak & Company, Inc., 1974.

PROTOCOL VERIFICATION

National Bureau of Standards

Term and Scale of Effort: 2/79 - 10/79; .1 person years

Principal Investigator: Carl A. Sunshine

Networking makes for more effective sharing of communications resources and services. The networking process requires "protocols"—or rules of exchange—supporting communication between systems. Means must be developed for specifying and validating protocols to ensure consistent application by widely separated groups both within the United States and in other countries. Rand identified and evaluated the current international state of the art in protocol verification. The research:

- Identified and defined existing approaches to protocol verification.
- Described current work applying these approaches to the verification of protocols for file transfer and interprocess communication tasks.
- Listed perceived shortcomings in current approaches
- Described alternative approaches that may be appropriate to more sophisticated protocols.

MICROWAVE TELEVISION NETWORK AND LOCAL GOVERNMENT DECISIONMAKING

Metropolitan Regional Council of New York

Term and Scale of Effort: 6/71 - 5/74; 3 person years

Principal Investigators: Daniel J. Alesch and Leland L. Johnson

The Metropolitan Regional Council of New York is an organization of elected officials which encourages cooperation among local governments in an area adjacent to New York City. The Federal Communications Commission authorized the Council to construct and operate a two-way microwave video tele-conferencing system connecting government agencies spanning 17 counties in New York, New Jersey and Connecticut. The system was designed to improve the performance of local government agencies, stimulate collective action, and increase the diffusion of innovation in urban management techniques. Rand evaluated the impact and effectiveness of the system and recommended ways of improving its usefulness in regional government.

R-977-MRC, *Intergovernmental Communication in the New York-New Jersey-Connecticut Metropolitan Region*, D. J. Alesch, May 1972.

R-1000-MRC, *Method of Evaluation for the Metropolitan Regional Council Telecommunication System*, D. J. Alesch and G. C. Sumner, May 1972.

R-1489-MRC, *Two-Way TV Teleconferencing for Government: The MRC-TV System*, R. Bretz and L. A. Dougharty, April 1974.

R-1545-MRC, *Evaluation of Intergovernmental Communication: Statistical Baseline Analysis*, H. Sackman, May 1974.

TECHNICAL PROBLEMS OF CANADIAN DATA NETWORK INTERWORKING

University of Waterloo (Ontario, Canada)

Term and Scale of Effort: 1/78 – 4/79; .3 person years

Principal Investigator: Carl A. Sunshine

The Canadian Department of Communications and the University of Waterloo Computer Communications Network Group studied the technical problems of interconnecting the two major Canadian public data networks, in order to provide more uniform and widespread access to data communication services. The CCNG requested assistance from Rand.

BROADCASTING SATELLITE SYSTEM PLANNING AND COORDINATION STUDY

National Aeronautics and Space Administration

Term and Scale of Effort: 3/72 – 7/74; 1.8 person years

Principal Investigator: Edward E. Reinhart

Agreements on the assignment of radio spectrum frequencies and orbital positions for satellites are made at International and Regional Broadcasting Planning Conferences, the first of which convened in 1975. In preparation for those conferences, NASA requested Rand's assistance in developing a procedure for planning and coordinating the broadcasting satellite system.

R-1463-NASA, *Orbit-Spectrum Sharing between the Fixed-Satellite and Broadcasting-Satellite Services with Applications to 12 GHz Domestic Systems*, E. E. Reinhart, May 1974.

CLIMATE

THE EVOLUTION OF CLOUD AND RAINDROP SPECTRA

National Science Foundation

Term and Scale of Effort: 7/78 – 1/81; .2 person years

Principal Investigator: Diran Deirmendjian

This project set out to investigate the use of electromagnetic wave scattering techniques in cloud microphysics research related to the precipitation process. In particular, monochromatic (laser) radiation at the far infrared through millimeter wavelengths was to be considered for use in monitoring the appearance and evolution of the large cloud droplets essential to the initiation of warm cloud precipitation, and in measuring and monitoring the associated raindrop spectra. This effort has been limited to a thorough survey of current knowledge of evolving cloud droplet spectra (before and during a precipitation cycle). The ultimate objective is to recommend reliable monitoring systems for measuring changes in the microphysical parameters of candidate clouds under field conditions, as a check against theoretical predictions and as a means of enhancing knowledge of natural precipitation.

THE MONITORING OF ATMOSPHERIC PARTICULATE TURBIDITY

National Aeronautics and Space Administration

Term and Scale of Effort: 1/76 – 7/79; .8 person years

Principal Investigator: Diran Deirmendjian

In recent years, scientists have increased their study of particulate turbidity (minute separate particles constituting pollution) in the earth's atmosphere. Pollution generated by urban centers and industrial waste, the possible climatic effects of particulate turbidity, and the potential hazard of supersonic transport aircraft interference with the earth's natural stratosphere have added to their concern. In this project, Rand evaluated some existing and proposed techniques for detecting and monitoring atmospheric particulate turbidity.

N-1211-NASA, *Use of Light Scattering Phenomena in Atmospheric Aerosol Monitoring—A Survey*, D. Deirmendjian, June 1979.

"A Survey of Light Scattering Techniques Used in the Remote Monitoring of Atmospheric Aerosols," D. Diermendjian, *Review of Geophysics and Space Physics*, Vol. 18, No. 2, May 1980.

RESEARCH ON COUPLED OCEAN-ATMOSPHERE CLIMATE MODELS

National Science Foundation

Term and Scale of Effort: 6/75 – 4/77; 4.8 person years

Principal Investigator: W. Lawrence Gates

The ability to synthesize the climatic system as a whole results with numerical models of the general circulation. With such models we are able to simulate the time-averaged distributions of the various climatic elements, subject to the prescriptions of the model's internal physics and boundary conditions. Research on these and other questions has been under way at Rand for several years. The general objectives of this research were to develop and test a coupled general circulation model of the atmosphere-ocean system which could be used in the simulation of climatic change.

ATMOSPHERIC TEMPERATURE PROFILES

Department of Commerce (National Oceanic and Atmospheric Administration)

Term and Scale of Effort: 11/74 – 5/77; 1 person year

Principal Investigator: Harriet H. Kagiwada

Much effort is currently being expended on the determination of atmospheric temperature profiles based on satellite radiometric measurements. Rand developed a computational method, based on differential equations, to deal with this complex mathematical problem.

R-1745-DOC, *An Initial Value Method for Dual Integral Equations with Bessel Function Kernels*, H. H. Kagiwada and R. E. Kalaba, April 1975.

R-1810-DOC, *New Methods for Atmospheric Temperature Inversion*, H. H. Kagiwada and R. E. Kalaba, October 1975.

ICE-FORMING MECHANISMS IN THE ATMOSPHERE

National Science Foundation

Term and Scale of Effort: 3/75 – 9/76; .7 person years

Principal Investigators: Lloyd R. Koenig and Francis W. Murray

Even though ice plays an important role in rain formation, the complete story of how ice particles form in the atmosphere is still not known.

Observations in natural clouds sometimes reveal much higher concentrations of ice particles than would be expected from classical theory. Various "ice-multiplication" theories have been proposed to account for this discrepancy.

By alternatively including and excluding "ice multiplication" theories in a numerical model depicting the life-cycle of clouds, and comparing the resulting cloud developments with the observed evolution, Rand helped identify likely ice-producing mechanisms in natural clouds.

Rand staff addressed processes in low, warm-base clouds such as those found in the summer over the southeastern states. They studied high, cold-base clouds such as those found in the summer over the high plains states. Clouds in these two regions evolve in different ways, probably owing to the presence of ice-multiplication in the one case but not in the other. This work should aid the understanding of this difference, and hence lead to more complete knowledge of natural rain processes.

R-2424-NSF, *Theoretical Experiments on Cumulus Dynamics and Glaciation*, L. R. Koenig and F. W. Murray, January 1979.

CLIMATIC IMPACT ASSESSMENT PROGRAM

Department of Transportation

Term and Scale of Effort: 8/72 - 6/74; 4.3 person years

Principal Investigator: Robert R. Rapp

Rand's past research on the causes of climatic change provided a foundation for this assessment of the climatic impact of high-altitude aircraft. The study attempted to validate an extremely complex numerical model that simulates climatic change, and make a detailed analysis of the effects of particulate matter in the atmosphere on global climate. Rand also investigated the possible biological effects of interference with natural processes in the stratosphere caused by high-flying aircraft.

R-1298-DOT, *The Statistical Analysis of Simulated Climatic Change*, M. Warshaw, September 1973.

SPACE SCIENCES

SYNTHETIC APERTURE RADAR INVESTIGATION GROUP OF THE VENUS ORBITING IMAGING RADAR MISSION

Jet Propulsion Laboratory

Term and Scale of Effort: 1/80 – 1/81; .2 person years

Principal Investigator: Merton E. Davies

The principal investigator is a member of the Synthetic Aperture Radar Investigation Group of the Venus Orbiting Imaging Mission. He heads the Geodesy/Cartography Working Group. Images of Venus taken by the Synthetic Aperture Radar will be used to compute photogrammetrically the latitude and longitude of designated control points on Venus in order to establish a planetwide geodetic control network. This control net will be used in preparing maps of the planet. The spacecraft will be launched in 1986.

IMPROVED ACCURACY OF COORDINATES OF FEATURES OF MARS

National Aeronautics and Space Administration

Term and Scale of Effort: 4/79 – 12/81; 2.0 person years

Principal Investigator: Merton E. Davies

Very accurate coordinates of control points located within a few degrees of the Viking I landing site will be computed photogrammetrically using a block of about 50 Viking pictures. This will be possible because the Viking lander radio science team has determined the latitude and planetary radius of the Viking I lander very precisely, and the lander site has been identified on Viking orbiter pictures. In addition, a block of about 100 pictures will be used to build a geodetic tie between the crater Airy-O and the Viking I landing site. The 0 degree meridian on Mars passes through the center of Airy-O, thus defining the system of longitudes on the planet.

These new data will update and improve the accuracy of the planetwide control net of Mars using a single, large-block analytical triangulation.

R-2600-NASA, *Improved Coordinates of Features in the Vicinity of the Viking 1 Lander Site on Mars*, M. E. Davies and S. H. Dole, March 1980.

GEODETIC CONTROL OF THE GALILEAN SATELLITES

National Aeronautics and Space Administration

Term and Scale of Effort: 12/78 – 12/80; 2.7 person years

Principal Investigator: Merton E. Davies

Voyager I returned pictures of the Galilean satellites of Jupiter in late February and early March 1979, and Voyager 2 returned pictures in July 1979. The principal investigator is responsible for defining the coordinate systems and determining the coordinates of features on these four large satellites. He will compute control nets photogrammetrically from the Voyager pictures using methods similar to those used for the planets Mars and Mercury.

Camera orientation matrices derived from analytical triangulation computation of the control nets will be used to prepare photomosaics and color photomaps of the Galilean satellites by the Center of Astrogeology, U.S. Geological Survey (USGS), Flagstaff and the Image Processing Laboratory at the Jet Propulsion Laboratory. The control nets will also be necessary for the preparation of new shaded relief maps to be produced by USGS.

R-2532-JPL/NASA, *Control Networks for the Galilean Satellites: November 1979*, M. E. Davies, T. A. Hauge, F. Y. Katayama and J. A. Roth, November 1979.

THE GALILEO MISSION TO JUPITER, 1984

Jet Propulsion Laboratory

Term and Scale of Effort: 4/78 – 2/82; 1.9 person years

Principal Investigator: Merton E. Davies

The principal investigator is a member of the Galileo Imaging Science Team and chairman of the team's Hardware Subgroup. A new camera, called a charge coupled device (CCD), containing an 800 x 800 pixel format is under development for this mission. A single CCD camera with a 1500mm-focal-length optical system will be mounted on the scan platform of the orbiting spacecraft.

The Galileo spacecraft will be launched in late February or early March 1984, will fly by Mars and will go into orbit around Jupiter in late 1986. A separate spacecraft will send a probe into the atmosphere of Jupiter. The orbiting spacecraft will make about 10 close encounters of moons Europa, Ganymede, and Callisto during its first year in orbit.

THE CONTROL NET OF MARS: VIKING PHOTO ANALYSIS

National Aeronautics and Space Administration

Term and Scale of Effort: 12/76 – 12/77; 1.4 person years

Principal Investigator: Merton E. Davies

This project extended the control net of Mars by introducing Viking pictures into the Mariner 9 net. Advantage was taken of the extensive coverage provided by the Viking data to fill selected regions where prior coverage was inadequate. Precise coordinates of the Viking 1 lander site and the spin axis of Mars were determined by the Viking Lander Radio Science Team; these parameters were incorporated in the control net computations.

R-2309-NASA, *Control Net of Mars: February 1978*, M. E. Davies, F. Y. Katayama, and J. A. Roth, February 1978.

"The Prime Meridian of Mars and the Longitude of the Viking Landers," M. E. Davies, *Science*, Vol. 197, No. 4310, 23 September 1977.

"The Control Net of Mars: May 1977," M. E. Davies, *Journal of Geophysical Research*, Vol. 83, No. B5, 10 May 1978.

LUNAR POLAR ORBITER SPECTRO-STEREO IMAGING EXPERIMENT

Jet Propulsion Laboratory

Term and Scale of Effort: 7/76 – 3/77; .1 person years

Principal Investigator: Merton E. Davies

NASA had planned to launch a polar-orbiting spacecraft in 1980 to survey the entire lunar surface. The principal investigator headed the Spectro-Stereo Imaging Experimenter Team until plans for the mission were cancelled.

ASSESSMENT OF POSSIBLE COOPERATIVE DEEP SPACE MISSIONS BY THE UNITED STATES AND THE SOVIET UNION

Jet Propulsion Laboratory

Term and Scale of Effort: 4/76 – 9/76; .1 person years

Principal Investigator: Merton E. Davies

This assessment included an analysis of the costs, risks, and benefits of possible cooperative missions to take place between 1980 and the early 1990s.

ATLAS OF MERCURY

National Aeronautics and Space Administration

Term and Scale of Effort: 3/76 - 10/77; 1 person year

Principal Investigator: Merton E. Davies

This work involved the preparation and photographic reproduction of about 200 review copies of a Mariner 10 atlas of Mercury. The text discusses the Mariner 10 mission and the planet Mercury. Maps of the surface of the planet and a large number of photographs taken by Mariner 10 are included. References, an index, and a gazetteer were also prepared.

Atlas of Mercury M. E. Davies, S. E. Dwornik, O. E. Gault, and R. G. Strom, Government Printing Office, 1978.

EXPANDING THE GEODETIC CONTROL NETWORKS OF MERCURY FROM THE MARINER 10 TV PICTURES

National Aeronautics and Space Administration

Term and Scale of Effort: 12/74 - 12/76; 1.7 person years

Principal Investigator: Merton E. Davies

This project involved extending the control net of Mercury by adding pictures and points to the existing computations. New coordinates of the control points were determined, and their identifications and the spacecraft orientation matrices (at the time when the pictures were taken) were furnished to the U.S. Geological Survey, Flagstaff, and to the Image Processing Laboratory, Jet Propulsion Laboratory, for use in the computer mosaicing of pictures and in overlaying the coordinate grid on the new maps of Mercury.

R-1914-NASA, *The Control Net of Mercury: January 1976*, M. E. Davies, January 1976.

R-2089-NASA, *The Control Net of Mercury: November 1976*, M. E. Davies and F. Y. Katayama, November 1976.

R-2090-NASA, *Control Point Measurements on Mariner 10 Pictures of Mercury*, M. E. Davies, F. Y. Katayama, and J. A. Roth, November 1976.

R-2091-NASA, *Identification of Control Points on Mercury*, M. E. Davies and J. A. Roth, November 1976.

CONTROL NETWORK OF MARS

National Aeronautics and Space Administration

Term and Scale of Effort: 11/70 – 10/74; .6 person years

Principal Investigator: Merton E. Davies

The pictures of the planet Mars returned by Mariners 6 and 7 offered the first opportunity to derive photogrammetrically a planetwide control net based on topographic features. The control net consists of coordinates (latitude, longitude) of numbered features observed on the surface of the planet. It is used to position those features relative to the latitude, longitude grid in the preparation of maps. Programs were written to carry out the single-block analytical triangulation.

Introduction of Mariner 9 pictures into the control net was a major improvement, as the surface coverage was of uniformly higher resolution; however, a large number of pictures were required for full coverage. Thus, although the net became more accurate, the computations became larger and more cumbersome. New computer routines were introduced to simplify the computations.

R-1525-NASA, *Mariner 9 Control Net of Mars: May 1974*, M. E. Davies, May 1974.

"Coordinates of Feature on the Mariner 6 and 7 Pictures of Mars," M. E. Davies, *Icarus* Vol. 17, No. 1, August 1972.

ASSISTANCE TO THE PRESIDENT'S SCIENTIFIC COUNCIL

Office of Science and Technology

Term and Scale of Effort: 6/71 – 6/73; .2 person years

Principal Investigator: Merton E. Davies

In preparation for meetings of a subpanel of the President's Scientific Advisory Council, Rand prepared research reports comparing the U.S. and Soviet space programs.

VOYAGER 1 AND 2 MISSION TO JUPITER, SATURN, URANUS, NEPTUNE, 1977

Jet Propulsion Laboratory

Term and Scale of Effort: 2/73 – 3/81; 7 person years

Principal Investigator: Merton E. Davies

The principal investigator is a member of the Imaging Science Team for the Voyager missions to Jupiter and Saturn. The imaging system consists of

two vidicon cameras of the same type flown on Mariner 9 and 10 with many modifications. The focal lengths of the lenses are 200 mm and 1500 mm.

Voyager 1 was launched 5 September 1977, encountered Jupiter 5 March 1979, will pass by Saturn on 12 November 1980, and will then leave the solar system. Voyager 2 was launched on 20 August 1977 on a slower trajectory. It encountered Jupiter on 9 July 1979 and will fly by Saturn on 27 August 1981, Uranus on 24 January 1986, and Neptune on 25 August 1989, before leaving the solar system.

R-2532-JPL/NASA, *Control Networks for the Galilean Satellites: November 1979*, M. E. Davies, T. A. Hauge, F. Y. Katayama, and J. A. Roth, November 1979.

"Voyager Imaging Experiment," B. A. Smith et al., *Space Science Reviews*, Vol. 21, No. 2, November 1977.

"The Jupiter System Through the Eyes of Voyager 1," B. A. Smith et. al., *Science*, Vol. 204, No. 4396, 1 June 1979.

"The Galilean Satellites and Jupiter: Voyager 2 Imaging Science Results," B. A. Smith et al., *Science*, Vol 206, No. 4421, 23 November 1979.

PARTICIPATION IN PREPARATIONS FOR THE GRAND TOUR MISSIONS TO THE OUTER SOLAR SYSTEM

National Aeronautics and Space Administration

Term and Scale of Effort: 5/71 – 2/72; .2 person years

Principal Investigator: Merton E. Davies

The principal investigator served on the Imaging Science Team for a study of the Grand Tour missions to the outer solar system. Such teams specify the scientific objectives of space missions and evaluate and recommend specific image-making instruments for use.

MARINER 10 MISSION TO VENUS AND MERCURY, 1973

Jet Propulsion Laboratory

Term and Scale of Effort: 11/70 – 6/76; 3 person years

Principal Investigator: Merton E. Davies

The principal investigator was a member of the Television Experimenter Science Team for the Mariner 10 mission to Venus and Mercury. Mariner 10 carried two television cameras similar to those sent to Mars on Mariner 9; however, they both had 1500 mm, f/8.4 lenses (in contrast to Mariner 9's 50 mm and 500 mm focal-length lenses) to permit high-resolution pictures of Mercury as the spacecraft flew by the dark side of the planet.

Mariner 10 was launched on 2 November 1973 and encountered Venus on 5 February 1974. The aiming point at Venus was chosen so that the gravity of Venus would bend the trajectory by the correct amount to send the spacecraft to Mercury. Mariner 10 made its first (dark side) flyby of Mercury on 29 March 1974 and went into solar orbit. The period of this orbit (176 days) was exactly twice the period of Mercury's orbit (88 days); the rotation period of Mercury on its axis is exactly two-thirds of its orbital period (58 days). Thus, as Mariner 10 went around the Sun once, Mercury went around twice and rotated around its axis three times. Exactly the same face of Mercury was illuminated by the Sun for the second encounter on 21 September 1974. However, the aiming point was chosen for a bright-side pass so that pictures of most of the illuminated face were obtained. The third encounter was disappointing; it was another dark-side pass and communication problems limited the pictures to partial frames.

R-1740-JPL, *Surface Coordinates and Cartography of Mercury*, M. E. Davies and R. M. Batson, March 1975.

"Imaging Mercury and Venus from a Flyby," B. C. Murray, et al., *Icarus*, Vol.15, No. 2, October 1971.

"Venus: Atmospheric Motion and Structure from Mariner 10 Pictures," B. C. Murray, et. al., *Science*, Vol. 183, No. 4131, 29 March 1974.

"Mercury's Surface: Preliminary Description and Interpretation from Mariner 10 Pictures," B. C. Murray et. al., *Science*, Vol. 185, No. 4146, 12 July 1974.

"Preliminary Imaging Results from the Second Mercury Encounter," R. G. Strom et. al., *Journal of Geophysical Research*, Vol. 80, No. 17, 10 June 1975.

"Surface Coordinates and Cartography of Mercury, M. E. Davies and R. M. Batson, *Journal of Geophysical Research*, Vol. 80, No. 17, 10 June 1975.

MARINER 6 AND 7 MISSIONS TO MARS, 1969; MARINER 9 MISSION TO MARS, 1971

Jet Propulsion Laboratory

Term and Scale of Effort: 10/70 – 8/73; 4 person years

Principal Investigator: Merton E. Davies

The principal investigator was a member of the Television Science Team of the Mariner 6 and 7 flyby missions to Mars and of the Mariner 9 orbiting mission to Mars. The team was responsible for development of the television cameras, selection of the picture-taking sequences, image processing of the pictures, and scientific interpretation of the data.

The Mariner 6 and 7 spacecraft, which were launched in the spring of 1969, flew by Mars on 31 July and 5 August of the same year, taking a total

of about 200 pictures, including 57 near-encounter, high-resolution frames. The Mariner 9 spacecraft was launched on 30 May and was inserted into orbit around Mars on 14 November 1971. During its single year of life in orbit, Mariner 9 took pictures of the entire surface of Mars at 1 to 5 km resolution.

R-1122-JPL, *Mariner 9 Control Net of Mars: August 1972*, M. E. Davies, October 1972.

R-1252-JPL, *Martian Surface Coordinates*, M. E. Davies and D. W. G. Arthur, April 1973.

R-1266-JPL, *Mariner 9 Control Net of Mars: April 1973*, M. E. Davies, April 1973.

R-1332-JPL, *Control Point Measurements on Mariner 9 Pictures*, M. E. Davies, July 1973.

"Mariner 6 Television Pictures: First Report," R. B. Leighton et al., *Science*, Vol. 165, 15 August 1969.

"Mariner 7 Television Pictures: First Report," R. B. Leighton et al., *Science*, Vol. 165, 22 August 1969.

"Mariner 6 and 7 Television Pictures: Preliminary Analysis," R. B. Leighton et al., *Science*, Vol. 166, 3 October 1969.

"Net of Mars," M. E. Davies and R. A. Berg, *Journal of Geophysical Research*, Vol. 76, No. 2, 10 January 1971.

"Mercator Photomap of Mars," J. A. Cutts, G. E. Danielson, and M. E. Davies, *Journal of Geophysical Research*, Vol. 76, No. 2, 10 January 1971.

"Television Experiment for Mariner Mars 1971," H. Masursky et al., *Icarus*, Vol. 12, No. 1, January 1970.

"Mariner 9 Television Reconnaissance of Mars and Its Satellites: Preliminary Results," H. Masursky et al., *Science*, Vol. 175, 21 January 1972.

"Martian Surface Coordinates," M. E. Davies and D. W. G. Arthur, *Journal of Geophysical Research*, Vol. 78, No. 20, 10 July 1973.

"Mariner 9 Areographic Coordinate System," G. de Vaucouleurs, M. E. Davies, and F. M. Sturms, Jr., *Journal of Geophysical Research*, Vol. 78, No. 20, 10 July 1973.

"Mariner 9: Primary Control Net," M. E. Davies, *Photogrammetric Engineering*, Vol. XXXIX, No. 12, December 1973.

"Photogrammetric Measurements of Olympus Mons on Mars," M. E. Davies, *Icarus*, Vol. 21, No. 3, March 1974,

TRANSPORTATION AND THE ENVIRONMENT

THE STAR STUDY: IMPACTS OF ALTERNATIVE INTERCITY SHORT-HAUL TRANSPORTATION SYSTEMS ON THE CALIFORNIA CORRIDOR

Department of Transportation

Term and Scale of Effort: 12/71 - 7/74; 7.8 person years

Principal Investigator: Bruce F. Goeller

The STAR (Shorthaul Transportation Analysis for Research and Development) Study assisted the Department of Transportation in setting policy for research and development on shorthaul (50-to-500 mile) transportation systems of the 1980s. Rand predicted and compared the impact of five alternative transportation systems on travelers, residents, communities, the economy, and the environment in the California Corridor region (San Diego to Sacramento).

R-1359-DOT, *The STAR Methodology for Short-Haul Transportation: Transportation System Impact Assessment*, L. G. Chesler and B. F. Goeller, December 1973.

R-1359/1-DOT, *The STAR Methodology for Short-Haul Transportation: Regional Description*, C. N. Johnson and K. M. Eisenstadt, December 1973.

R-1359/2-DOT, *The STAR Methodology for Short-Haul Transportation: Demand Prediction—Approach and Calibration*, D. M. de Ferranti, B. F. Goeller, and L. G. Chesler, December 1973.

R-1359/3-DOT, *The STAR Methodology for Short-Haul Transportation: Transportation System Description*, L. Roennau, J. W. Higgins, T. F. Kirkwood, R. L. Petruschell, and H. Porch, December 1973.

R-1359/4-DOT, *The STAR Methodology for Short-Haul Transportation: Prediction of Service and Financial Impacts Using the Supply-Demand Program*, L. G. Chesler and R. E. Stanton, December 1973.

R-1359/5-DOT, *The STAR Methodology for Short-Haul Transportation: Prediction of Economic Impacts from System Construction*, B. K. Burright, December 1973.

R-1359/6-DOT, *The STAR Methodology for Short-Haul Transportation: Prediction of Community Environmental and Social Impacts*, J. R. Gebman, G. M. Burkholz, S. K. Anderson, S. H. Dole, M. L. Freeman, C. N. Johnson, T. Repnau, and B. Yormark, December 1973.

R-1359/7-DOT, *The STAR Methodology for Short-Haul Transportation: Description of Census Data Programs*, C. N. Johnson, December 1973.

R-1359/8-DOT, *The STAR Methodology for Short-Haul Transportation: Description of Noise Impact Assessment Programs*, J. R. Graham, G. M. Burkholz, S. K. Anderson, M. L. Freeman, T. Repnau, and B. Yormark, December 1973.

SAN DIEGO CLEAN AIR PROJECT

San Diego County

Term and Scale of Effort: 6/72 - 9/73; 5.4 person years

Principal Investigator: Bruce F. Goeller

Rand evaluated various strategies for controlling air pollution in San Diego to meet federal air quality standards by 1977, including (1) imposing additional controls on fixed-source and auto emissions, petroleum handling, organic solvent use, and aircraft, and (2) improving bus service.

R-1362-SD, *San Diego Clean Air Project: Summary Report*, B. F. Goeller, December 1973.

R-1362/1-SD, *San Diego Clean Air Project: Executive Summary*, B. F. Goeller, December 1973.

R-1363-SD (Appendix 1), *Cost and Effectiveness of Strategies for Reducing Emissions from Fixed Sources: The San Diego Basin, 1975*, J. C. De Haven and B. M. Woodfill, December 1973.

R-1364-SD (Appendix 2), *The Motor Vehicle Emission and Cost Model (MOVEC): Model Description and Illustrative Applications*, W. T. Mikolowsky, December 1973.

R-1365-SD (Appendix 3), *A Generalized Bus System Cost Model*, R. L. Petruschell and T. F. Kirkwood, December 1973.

R-1366-SD (Appendix 4), *A Policy-Oriented Urban Transportation Model: The San Diego Version*, J. H. Bigelow, B. F. Goeller, and R. L. Petruschell, December 1973.

ALTERNATIVE OXIDANT CONTROLS FOR THE LOS ANGELES AIR QUALITY CONTROL REGION

Environmental Protection Agency

Term and Scale of Effort: 2/73 - 6/74; 1.4 person years

Principal Investigator: Bruce F. Goeller

In January 1973, the Environmental Protection Agency announced that to meet national air quality standards, Los Angeles might have to reduce vehicle mileage traveled by more than 80 percent through a massive gas

rationing program. In a search for less drastic alternatives, Rand screened many strategies for controlling hydrocarbon and nitrogen oxides emissions, considering such measures as imposing strict controls on fixed-source emissions, retrofitting older cars with control devices, instituting vehicle inspection and maintenance programs, and making bus system improvements.

R-1368-EPA, *Strategy Alternatives for Oxidant Control in the Los Angeles Region*, B. F. Goeller, J. H. Bigelow, J. C. De Haven, W. T. Mikolowsky, R. L. Petruschell, and B. M. Woodfill, December 1973.

REDUCING VEHICLE MILES OF TRAVEL: AIR QUALITY AND NOISE IMPACT ANALYSIS OF ALTERNATIVE TRANSPORTATION SYSTEMS

Southern California Association of Governments

Term and Scale of Effort: 12/73 - 7/74; 1.2 person years

Principal Investigator: Howard W. McFarland

Rand developed and evaluated strategies for achieving a reduction in vehicle miles of travel in the Los Angeles Air Quality Control Region by 1977, studying their impact on air quality, energy conservation, and transportation service. In addition, Rand determined the average daily rate of smog-producing emissions for years through 1990 under a normal evolution of today's transportation systems.

R-1524-SCAG, *The Regional Impacts of Near-Term Transportation Alternatives: A Case Study of Los Angeles*, W. T. Mikolowsky, J. R. Gebman, W. C. Stanley, and G. M. Burkholz, June 1974.

AIR TRAFFIC CONTROL STUDIES

Department of Transportation

Term and Scale of Effort: 11/71 - 7/73; 6.2 person years

Principal Investigator: Howard W. McFarland

During the 1960s, air traffic increased at an unexpectedly rapid rate, and airports and air traffic control facilities could not deal adequately with the additional load. The Department of Transportation sponsored studies of short- and long-term solutions to the air traffic control problem. By focusing on air traffic management concepts for the late 1980s and beyond, these studies supplemented the Federal Aviation Administration's Ten-Year Plan. Rand provided analytical support to the Department of Transportation by developing cost and benefit estimates of alternative advanced air traffic management systems.

R-1319-DOT, *Cost Comparisons of Advanced Air Traffic Management Systems*, D. J. Dreyfuss, H. E. Boren, Jr., F. S. Kontrovich, J. R. Lind, P. A. CoNine, and N. E. Feldman, July 1973.

R-1320-DOT, *Some User Benefits Achievable from an Advanced Air Traffic Management System*, T. F. Kirkwood, G. K. Smith, W. L. Stanley, S. Wildhorn, and R. J. Gladstone, July 1973.

COMPUTER STUDIES

MACHINE-AIDED KNOWLEDGE ACQUISITION

National Science Foundation

Term and Scale of Effort: 6/77 – 12/79; 2 person years

Principal Investigator: Frederick Hayes-Roth

Recent experiments in computer-based learning have indicated that: (1) pattern learning and rule induction can be accomplished by computer algorithms, even when the training data contain errors or are incomplete; (2) such learning requires that the common properties of the various examples belonging to the same category be generalized or *abstracted;* (3) machine-aided knowledge acquisition can be a cost-effective alternative to the hand-crafting of rules in developing a knowledge-based system; (4) superior classifications and inferences can be obtained when the details of training examples are preserved and induction is delayed until an actual problem context is specified; and (5) the same inference-matching learning theory that underlies our computer-learning algorithms also models experimental data on human concept-learning and decisionmaking better than conventional psychological theories. The key operation in this learning paradigm is the process of partially matching descriptions, and it appears that significant economies can be realized by optimizing this process. The aim of the proposed work is to formalize the results of previous work on descriptive data structures and partial-matching and to extend them, as applicable, to machine-aided knowledge acquisition.

R-2540-NSF, *Knowledge Acquisition, Knowledge Programming and Knowledge Refinement*, F. Hayes-Roth, P. Klahr, and D. J. Mostow, May 1980.

N-1007-NSF, *Machine Aided Heuristic Programming: A Paradigm for Knowledge Engineering*, F. Hayes-Roth and F. Mostow, February 1979.

N-1185-NSF, *Cognitive Economy*, D. Lenat, F. Hayes-Roth, and P. Klahr, June 1979.

N-1543, *Theory-Driven Learning: Proofs and Refutations as a Basis for Concept Discovery*, F. Hayes-Roth, November 1979.

"An Interference Matching Technique for Inducing Abstractions," F. Hayes-Roth and J. McDermott, *Communications of the ACM*, Vol. 21, No. 5, May 1978.

P-6241, *Machine Methods for Acquiring, Learning, and Applying Knowledge*, F. Hayes-Roth, P. Klahr, J. Burge, and D. Mostow, October 1978

P-6517, *Advice-Taking and Knowledge Refinement: an Interactive View of Skill Acquisition*, F. Hayes-Roth, P. Klahr, and D. Mostow, June 1980.

COMPUTER SECURITY EVALUATION AND ENHANCEMENT

National Science Foundation

Term and Scale of Effort: 6/76 - 6/80; 3 person years

Principal Investigators: R. Stockton Gaines, Rein Turn, and Norman Z. Shapiro

This research addressed two closely related topics in computer security: evaluation of the degree of protection provided for information stored in a computer system, and enhancement of that security through hardware and software techniques and authentication of users of computer systems. Most of the recent work in computer security has been directed toward providing completely impenetrable computer operating systems. As this goal, if indeed achieved, will affect only a few specially constructed systems, Rand studied how to provide a degree of security commensurate with the value of the data stored. The project staff sought to identify the full range of issues that must be addressed before deciding whether to entrust sensitive information to a computer.

R-2526-NSF, *Authentication by Keystroke Timing: Some Preliminary Results*, R. S. Gaines, W. J. Lisowski, S. J. Press, and N. Z. Shapiro, May 1980.

STUDIES IN THE PSYCHOLOGY OF MAN-COMPUTER PROBLEM-SOLVING

National Science Foundation

Term and Scale of Effort: 3/72 - 8/74; 2.3 person years

Principal Investigators: Barry W. Boehm and Harold Sackman

Because of reductions in the cost of computer time, coupled with increased demands for "hands on" use of computers by professional and technical per-

sonnel other than programmers, a user's time is generally more valuable than that of the computer he is using. A better understanding of the man-computer relationship would permit the design of computer systems to augment human problem-solving, and thus increase the user's efficiency. Rand studied personal factors that affect the problem-solving process, problem-solving modes, hardware and system characteristics that affect problem-solving, and measures required to evaluate such variables.

R-1205-NSF, *Preliminary Investigation of Real-World Problem Solving with and without Computers: Vol. I, Summary*, H. Sackman, April 1973.

R-1205/1-NSF, *Preliminary Investigation of Real-World Problem Solving with and without Computers: Vol. II, Complete Results*, H. Sackman, April 1973.

R-1490-NSF, *Stages of Problem Solving with and without Computers*, H. Sackman, May 1974.

R-1491-NSF, *Rudiments of a Real-World Theory of Man-Computer Problem Solving*, H. Sackman, April 1974.

R-1492-NSF, *Studies in Real-World Problem Solving with and without Computers*, H. Sackman and F. W. Blackwell, May 1974.

DATA BANK PRIVACY PROTECTION

National Science Foundation

Term and Scale of Effort: 7/71 – 3/74; 3.5 person years

Principal Investigators: Mario L. Juncosa and Rein Turn

Our society has become increasingly concerned with protecting information in computer data banks from invasion of privacy or violations of security. Rand investigated various philosophical, theoretical, and technical aspects of privacy protection in such data banks.

R-1044-NSF, *Privacy and Security in Personal Information Databank Systems*, R. Turn, March 1974.

R-1282-NSF, *The Application of Information Theory to Privacy in Data Banks*, I. S. Reed, May 1973.

R-1361-NSF, *Privacy and Security in Databank Systems: An Annotated Bibliography, 1970-1973*, K. Hunt and R. Turn, March 1974.

R-1382-NSF, *Uncrackable Data Banks*, N. Z. Shapiro and M. Davis, November 1973.

R-1494-NSF, *Certain Number-Theoretic Questions in Access Control*, S. M. Johnson, January 1974.

"Privacy and Security in Centralized U.S. Decentralized Databank Systems," R. F. Shapiro and R. Turn, *Policy Sciences*, Vol. 7, 1976.

WORKSHOP ON TECHNICAL IMPLICATIONS OF PRIVACY LEGISLATION

National Science Foundation

Term and Scale of Effort: 5/74 – 12/75; .4 person years

Principal Investigators: R. Stockton Gaines and Willis H. Ware

In order to provide Congress and state legislatures with information on the technical requirements and costs implied by the various safeguards included in pending computer privacy legislation, Rand conducted a workshop and seminar for representatives from the data processing community and staff members of Congressional committees charged with drafting privacy legislation.

SCIENCE, TECHNOLOGY, AND METHODOLOGY

INVESTIGATION INTO POLITICAL SCIENCE USING METHODS OF GAME THEORY

National Science Foundation

Term and Scale of Effort: 7/78 – 7/81; 1 person year

Principal Investigator: Lloyd S. Shapley

The mathematical theory of games is finding a number of promising points of application in political science: in the mathematical modeling of campaigns and other political competitions; in the area of logrolling, coalition-forming, and utility aggregation; and in the identification, formal definition, and measurement of intangibles like "power," "responsibility," and "initiative." Rand staff will apply the recently developed methodology of non-atomic games to models in political theory that involve very large numbers of voters.

Non-atomic games are mathematical models (as opposed to laboratory games) in which there are large masses of decisionmakers who are quite powerless as individuals, but who can make their influence felt when they form parties or coalitions. Such models, pioneered a decade or more ago by Shapley and others, are now widely used in mathematical economics, where one often has to deal with large masses of individually insignificant consumers. But the potential of models of this kind for political science applications has hardly begun to be exploited, despite rapidly increasing use of other mathematical and game-theoretical tools in that discipline.

A SYSTEMATIC TREATMENT OF ECONOMICS BY GAME THEORY

National Science Foundation

Term and Scale of Effort: 12/71 - 1/81; 4.3 person years

Principal Investigator: Lloyd S. Shapley

Many branches of economics are now accessible to game-theoretic methodology. The classical field of oligopoly, for example, can be satisfactorily explained only by game theory, and n-person game theory seems a promising technique for dealing with "externalities" (side effects) in economic systems. With the rising need for finding equitable ways to deal with social problems where the presence of externalities is critical, the development of an adequate theory would contribute to the solution of national problems. Rand is developing and extending the applications of game theory in economics, especially as a test for rational economic models.

R-904/1-NSF, *Game Theory in Economics, Chapter 1: Introduction. The Use of Models*, L. S. Shapley and M. Shubik, December 1971.

R-904/2-NSF, *Game Theory in Economics, Chapter 2: Decisionmakers*, L. S. Shapley and M. Shubik, January 1972.

R-904/3-NSF, *Game Theory in Economics—Chapter 3: The Rules of the Game*, L. S. Shapley and M. Shubik, October 1972.

R-904/4-NSF, *Game Theory in Economics—Chapter 4: Preferences and Utility*, L. S. Shapley and M. Shubik, December 1974.

R-904/6-NSF, *Game Theory in Economics—Chapter 6: Characteristic Function, Core, and Stable Set*, L. S. Shapley and M. Shubik, July 1973.

R-1056-1-NSF, *On Cores and Indivisibility*, L. S. Shapley and E. Scarf, September 1973.

R-1476-NSF, *An Example of a Slow-Converging Core*, L. S. Shapley, January 1974.

R-1692-NSF, *Competitive Outcomes in the Cores of Market Games*, L. S. Shapley and M. Shubik, March 1975.

R-1851-NSF, *Trade Using One Commodity as a Means of Payment*, L. S. Shapley and M. Shubik, April 1976.

R-2186-NSF, *Uniqueness of Noncooperative Equilibria in a Trading Economy with Market Supply and Bidding Strategies*, L. V. Heyden, July 1977.

COST RELIABILITY/MAINTAINABILITY STUDY FOR ADVANCED GENERAL AVIATION AVIONICS SYSTEMS FOR OPERATION IN THE 1980s

National Aeronautics and Space Administration

Term and Scale of Effort: 12/76 - 5/79; 2.2 person years

Principal Investigator: Malcolm R. Davis

General aviation forms a large and important segment of the total U.S. civil aviation activity. There is, however, significant uncertainty about the future of general aviation in the United States because of the unknown impact of Federal Aviation Administration regulations requiring increasingly complex and costly equipment to operate in the National Airspace System. Rand assisted NASA in developing a methodology for estimating cost, reliability, and maintenance requirements for advanced avionics equipment used in general aviation aircraft, and in applying this methodology to candidate avionics systems proposed to NASA by contractors. A major portion of this study involved the development of modeling techniques for predicting the cost, reliability, and maintainability of avionics systems based on new technology.

THREE-DIMENSIONAL MODELING USING PARTIAL DIFFERENTIAL EQUATIONS

National Science Foundation

Term and Scale of Effort: 11/74 - 1/78; 2 person years

Principal Investigator: Mario L. Juncosa

Scientists frequently rely on modeling or simulation to help solve problems in areas of national concern. Three-dimensional models of physical laws and processes can facilitate research dealing with the atmosphere, oceans, the environment, and many areas of technology and physical and life sciences. In this project, Rand compiled information on formulations, computer usage and requirements, programs, and experience gained in three-dimensional modeling problems.

GUIDELINES FOR A REVIEW OF THE POTENTIAL USE OF DEMONSTRATION PROJECTS TO PROMOTE FEDERAL CIVILIAN R&D UTILIZATION

Office of Technology Assessment

Term and Scale of Effort: 4/77 - 10/77; .9 person years

Principal Investigator: Thomas K. Glennan, Jr.

In many instances, demonstration projects have become a crucial policy tool in moving the projects of R&D from laboratories into private and public sector use. Recently, a number of studies have examined the planning and execution of a variety of demonstration projects. In this project, Rand synthe-

sized the findings of these studies to help Congress determine the use of demonstration projects and conditions under which they are most likely to succeed in realizing their intended public benefits.

R-2288-OTA, *The Role of Demonstrations in Federal R&D Policy*, T. K. Glennan, Jr., W. F. Hederman, L. L. Johnson, and R. A. Rettig, May 1978.

TECHNOLOGICAL INNOVATION AND PRODUCTIVITY/PRODUCT QUALITY CHANGE BY FIRMS

National Science Foundation

Term and Scale of Effort: 6/74 – 12/77; 1.5 person year

Principal Investigator: Alvin J. Harman

What are the current and potential influences of federal government actions and policies on firms' innovative activities? Rand developed means of measuring the extent of technological innovation—as either quality enhancement or cost reduction of a product type—and determined the influences and incentives that lead to innovation, using data from two capital goods industries: computers and machine tools.

R-2237-NSF, *Technological Innovation by Firms: Enhancement of Product Quality*, A. J. Harman, A. J. Alexander, M. R. Davis, and A. D. Lee, November 1977.

R-2237/1-NSF, *Technological Innovation by Firms: Data Appendices on Computers and Machine Tools*, A. J. Harman, A. J. Alexander, M. R. Davis, and A. D. Lee, November 1977.

EVALUATION OF FEDERALLY FINANCED DEMONSTRATION PROJECTS

National Bureau of Standards

Term and Scale of Effort: 6/74 – 4/76; 4.5 person years

Principal Investigators: Walter S. Baer and Leland L. Johnson

Demonstration projects generally represent the final stage of testing a new technology before deciding whether to adopt it commercially. During the past two decades, such projects have played a major role in the federal government's activities designed to stimulate innovation in civilian technology, including energy, health, education, the environment, and communications. Results of these demonstrations have been mixed. Rand undertook an assessment of demonstration projects spanning a wide range of technologies, studying such demonstrations as saline water conversion plants, dial-a-ride transportation systems, and the Maritime Satellite Program. The research aimed to develop guidelines for making demonstration projects more effective and

to assess their value relative to other means of promoting technological innovation.

R-1925-DOC, *Analysis of Federally Funded Demonstration Projects: Executive Summary*, W. S. Baer, L. L. Johnson, and E. W. Merrow, April 1976.

R-1926-DOC, *Analysis of Federally Funded Demonstration Projects: Final Report*, W. S. Baer, L. L. Johnson, and E. W. Merrow, April 1976.

R-1927-DOC, *Analysis of Federally Funded Demonstration Projects: Supporting Case Studies*, W. S. Baer, C. J. Conover, C. A. Cook, P. D. Fleischauer, B. F. Goeller, W. F. Hederman, L. L. Johnson, E. W. Merrow, R. A. Rettig, and J. G. Wirt, April 1976.

EARTHQUAKE FAULT STUDIES

California Earth Science Corporation

Term and Scale of Effort: 7/73 - 7/75; .6 person years

Principal Investigator: Carl Gazley, Jr.

Rand attempted to improve the detection of earthquake faults through computer and photographic enhancement of multispectral imagery (photographic and television pictures taken in different spectral bands) produced by Skylab and the Earth Resources Technology Satellite.

CALIFORNIA SCIENCE AND TECHNOLOGY PROJECT

State of California, Office of the Lieutenant Governor

Term and Scale of Effort: 4/72 - 8/74; 1.2 person years

Principal Investigator: Albert J. Lipson

Rand assisted the state in examining alternative methods to identify state research needs and priorities, apply in-house and outside research activities to state policy and administrative problems, and improve the delivery of science and technology to users in the state government.

P-4961, *Predicting Changes in Urban Form from Transportation System Changes: A Proposed Methodology*, J. H. Enns, B. K. Burright, P. deLeon, and B. F. Goeller, January 1973.

THE DEVELOPMENT OF IMPROVED RESEARCH, DEVELOPMENT AND EVALUATION MANAGEMENT PROCEDURES

Department of Health and Human Services (Assistant Secretary for Planning and Evaluation)

Term and Scale of Effort: 1/72 – 5/73; 3 person years

Principal Investigator: Roger E. Levien

Rand staff examined and documented methods that certain agencies in the Department of Health, Education, and Welfare employ to manage three major types of research and development: fundamental or basic research focused on gaining knowledge about natural phenomena, practice-oriented R&D that produces knowledge about directly useful products, and R&D directed at solving important national problems in a comparatively short time. The research, intended to build a theory of organization and management of social R&D, described management procedures, the organization of R&D activities within the various federal agencies, and the staffing plans used to support R&D management.

R-1156-HEW, *R&D Management: Methods Used by Federal Agencies*, J. G. Wirt, A. Lieberman, and R. E. Levien, January 1974.

THE NEW YORK CITY–RAND INSTITUTE

In 1968, the City of New York asked for Rand's assistance in developing a research program focused on some of the City's more urgent and complex problems. Rand began several studies under the broad heading of urban policy analysis (fire and police protection, housing, health, and welfare), later adding water pollution, the City's court and correctional systems, and the economic development of the City. The progress made during the first year of the program led to the formation in 1969 of the New York City–Rand Institute, a separate corporation administered by Rand and the City of New York. Its establishment represented the first attempt by a major city government and a research institution to work together in the continuing application of analytic techniques to problems of urban life and local government.

The Institute's aims were twofold: to assist the City and its agencies in improving operations and in providing a better basis for decisionmaking, and, ultimately, to contribute to the improvement of life in New York and in other urban centers. Support for the Institute's work came primarily from New York City and the Ford Foundation, with additional grants and contracts from the U.S. Department of Housing and Urban Development, the National Science Foundation, and the Office of Economic Opportunity.

Before closing in 1975, the Institute completed a number of studies that contributed to major policy analysis, bringing about changes in City agency policies and practices. The decision to dissolve the Institute was jointly taken by Rand and the City of New York when the City, faced with mounting budget problems, found itself unable to commit enough funds to the Institute to sustain it as a separate institution. The Institute began a formal process of dissolution in the fall of 1975, relying on the Domestic Research Division staff of The Rand Corporation for completion of research still in progress.

The major areas of research of the New York City–Rand Institute over the period 1969-1975 are reviewed briefly below. They are: Welfare, Health, Housing, Fire Protection, Law Enforcement and Criminal Justice, and Water Resources. Detailed information on the Institute's work may be found in the Institute's Final Report, 1969-1976, available from the Publications Department of Rand.

FIRE PROTECTION

In 1968, the major problem facing the Fire Department of New York City was the rising alarm rate. The Department's increasing workload was not significantly relieved by adding more men and equipment; nor were traditional methods of fire company allocation, dispatching, and relocation working.

The studies undertaken by the Institute succeeded in altering the way in which the Department manages and deploys its men and equipment, the operation of the dispatching system, and its fire-fighting technology. An integral part of the research involved the creation of a wide variety of computer models to analyze and evaluate deployment and enable the formulation of new policies. Computer systems were programmed to apply deployment decision rules for relocating fire equipment and for deciding the appropriate response to an alarm, doubling the Department's capacity to handle alarms during high alarm periods.

Many of the deployment strategies developed (for the Police as well as Fire Department) were later generalized to apply to cities other than New York. With the support of the U.S. Department of Housing and Urban Development, the Institute modified and field-tested computer models of deployment in cities of varying sizes throughout the country.

Based on an analysis of alarm rates for the City's street boxes, the Institute proposed the "adaptive response"-varying the number of men and amount of equipment dispatched depending on the likelihood of an alarm signaling a given type of hazard at a particular location and time of day. Additional research on deployment strategies and on reducing the average response time led to the relocation of seven fire companies and the closing of six others in late 1972.

The Institutes's most visible impact on fire-fighting technology came from the introduction in the Department of "slippery water." By adding trace elements of a special chemical to an engine's water pump to reduce friction, water flow is increased by 50 to 70 percent, doubling the reach of the hose stream. This permits smaller, lighter hoses to be used, allowing more maneuverability. The Institute also developed early fire detection and warning systems.

Fire Deployment Models

R-531-NYC/HUD, *Number of Emergency Units Busy at Alarms Which Require Multiple Servers*, J. M. Chaiken, March 1971.

R-532-NYC/HUD, *Response Areas for Two Emergency Units*, G. M. Carter, J. M. Chaiken, and E. J. Ignall, March 1971.

R-567-NYC/HUD, *An Extension of Erlang's Formulas Which Distinguishes Individual Servers*, J. M. Chaiken and E. J. Ignall, March 1971.

R-632-NYC, *A Simulation Model of Fire Department Operations: Design and Preliminary Results*, G. M. Carter and E. J. Ignall, November 1970.

R-681, *Urban Fire Protection: Studies of the Operations of the New York City Fire Department*, E. H. Blum, January 1971.

R-703-NSF, *Fire Insurance and the Inner City*, H. D. Shapiro, February 1971.

R-880-NYC, *An Early Detection and Warning System for Fires in Buildings*, R. D. Doctor, G. S. Levenson, and A. J. Tenzer, December 1971.

R-895-NYC, *Square-Root Laws for Fire Company Travel Distances*, P. Kolesar and E. H. Blum, June 1975.

R-968, *Deployment Research of the New York City Fire Project*, E. H. Blum, May 1972.

R-1023-NYC, *An Algorithm for the Dynamic Relocation of Fire Companies*, P. Kolesar and W. E. Walker, September 1972.

R-1188/1-HUD, *Simulation Model of Fire Department Operations: Executive Summary*, G. M. Carter, J. M. Chaiken, and E. J. Ignall, December 1974.

R-1188/2-HUD/NYC, *Simulation Model of Fire Department Operations: Program Description*, G. M. Carter, December 1974.

R-1214-NYC, *New York City Fire Alarm Prediction Models: II, Alarm Rates*, G. M. Carter and J. E. Rolph, January 1975.

R-1449-NYC, *Measuring the Travel Characteristics of New York City's Fire Companies*, P. Kolesar and W. E. Walker, April 1974.

R-1458-NYC, *Reducing Fire Engine Dispatching Delays*, A. J. Swersey, December 1973.

R-1506-NYC, *An On-Line Program for Relocating Fire-Fighting Resources*, C. E. Shanesy, June 1975.

R-1566/1-TRNTN, *An Analysis of the Deployment of Fire-Fighting Resources in Trenton, New Jersey*, J. Hausner and W. E. Walker, February 1975.

R-1566/2-HUD/CY, *An Analysis of the Deployment of Fire-Fighting Resources in Yonkers, New York*, J. Hausner, W. E. Walker, and A. J. Swersey, October 1974.

R-1566/3-HUD, *An Analysis of the Deployment of Fire-Fighting Resources in Denver, Colorado*, T. E. Hendrick, D. R. Plane, D. E. Monarchi, C. Tomasides, F. W. Heiss, and W. E. Walker, May 1975.

R-1566/4-HUD, *An Analysis of the Deployment of Fire-Fighting Resources in Jersey City, New Jersey*, K. L. Rider, J. Hausner, R. Shortell, J. Bligh, and T. Candiloro, August 1975.

R-1566/5-HUD, *An Analysis of the Deployment of Fire-Fighting Resources in Wilmington, Delaware*, W. E. Walker, D. Singleton, and B. Smith, July 1975.

R-1615-NYC/HUD, *A Parametric Model for the Allocation of Fire Companies*, K. L. Rider, April 1975.

R-1618/1-HUD, *Firehouse Site Evaluation Model: Executive Summary*, W. E. Walker, June 1975.

R-1618/2-HUD, *Firehouse Site Evaluation Model: Description and User's Manual*, P. Dormont, J. Hausner, and W. E. Walker, June 1975.

R-1624-NYC, *A Model for Predicting Average Fire Company Travel Times*, P. Kolesar, June 1975.

R-1646/1-HUD, *A Parametric Model for the Allocation of Fire Companies: Executive Summary*, K. L. Rider, August 1975.

R-1646/2-HUD, *A Parametric Model for the Allocation of Fire Companies: User's Manual*, K. L. Rider, August 1975.

R-1813-NSF, *Fire Protection and Local Government: An Evaluation of Policy-Related Research*, A. J. Swersey, E. J. Ignall, H. Corman, P. A. Armstrong, and J. I. Weindling, September 1975.

R-1853-HUD, *Deployment Methodology for Fire Departments*, J. M. Chaiken, E. J. Ignall, and W. E. Walker, September 1975.

R-1997-NYC, *An Algorithm for Initial Dispatch of Fire Companies*, G. M. Carter, E. J. Ignall, K. L. Rider, and A. J. Swersey, November 1977.

RM-5726-NYC, *The Service Facilities of the Bureau of Fire Communications: A Cost Analysis of a Proposed Consolidation*, G. S. Levenson and A. J. Tenzer, September 1968.

P-4512, *Fire Services: Challenge to Modern Management*, E. J. Blum, November 1970.

P-4625, *Predicting the Demand for Fire Service*, J. M. Chaiken and J. E. Rolph, May 1971.

P-4741, *Applications of Systems Analysis to Urban Fire Protection*, A. J. Swersey, November 1971.

P-4817, *Virtual Measures for Computer Simulation Experiments*, G. M. Carter and E. J. Ignall, April 1972.

P-4872, *Technology Aids Fire Service*, J. T. O'Hagan and E. H. Blum, June 1972.

P-4988, *Mathematical Programming Applications in the Analysis of the Deployment and Utilization of Fire-Fighting Resources*, P. Kolesar, March 1973.

P-5076, *Empirical Bayes Methods Applied to Spatial Analysis Problems*, G. M. Carter and J. E. Rolph, August 1973.

P-5091, *Square Root Laws for the Fire Engine Response Distances*, P. Kolesar and E. H. Blum, October 1973.

P-5110-1, *A Simulation Model of the New York City Fire Department: Its Use in Deployment Analysis*, G. M. Carter, E. J. Ignall, and W. E. Walker, July 1975.

P-5280, *Improving the Deployment of New York City Fire Companies*, E. J. Ignall, P. Kolesar, A. J. Swersey, W. E. Walker, E. H. Blum, G. M. Carter, and H. E. Bishop, July 1974.

P-5319, *Introduction to a Method for the Allocation of Fire Companies*, K. L. Rider, November 1974.

P-5409, *Fire Casualties and Their Relation to Fire Company Response Distance and Demographic Factors*, H. Corman, E. J. Ignall, K. L. Rider, and A. Stevenson, March 1975.

P-5416, *An Analysis of New York City Fire Department Expenditures from 1968 to 1974*, K. L. Rider and B. I. Jacobs, March 1975.

P-5420, *The Relationship between Fire-Fighting Unit Availability and the Number of Units Dispatched*, E. J. Ignall and R. Urbach, May 1975.

P-5426, *Performing Policy Analysis for Municipal Agencies: Lessons from The New York City–Rand Institute's Fire Project*, W. E. Walker, May 1975.

General Deployment Models

R-533-NYC/HUD, *On Insensitivities in Urban Redistricting and Facility Location*, R. C. Larson and K. A. Stevenson, March 1971.

R-675-HUD, *Response of Emergency Units: The Effects of Barriers, Discrete Streets, and One-Way Sreets*, R. C. Larson, April 1971.

R-680-HUD/NSF, *Methods for Allocating Urban Emergency Units*, J. M. Chaiken and R. C. Larson, May 1971.

R-1238-HUD, *A Hypercube Queuing Model for Facility Location and Redistricting in Urban Emergency Services*, R. C. Larson, March 1973.

R-1493-HUD, *Urban Emergency Service Systems: An Interative Procedure for Approximating Performance Characteristics*, R. C. Larson, January 1974.

R-1687-HUD, *Determining the Travel Characteristics of Emergency Service Vehicles*, J. Hausner, April 1975.

R-1784/1-HUD, *A Training Course in Deployment of Emergency Services: Instructor's Manual*, J. M. Chaiken, E. J. Ignall, and W. E. Walker, September 1975.

R-1784/2-HUD, *A Training Course in Deployment of Emergency Services: Student's Manual*, J. M. Chaiken, E. J. Ignall, and W. E. Walker, September 1975.

R-1867-HUD, *The Deployment of Emergency Services: A Guide to Selected Methods and Models*, W. E. Walker, September 1975.

P-4717, *Linear Programming Models of Crew Assignments for Refuse Collection*, E. J. Ignall, P. Kolesar, and W. E. Walker, November 1971.

P-4719, *Methods for Allocating Urban Emergency Units: A Survey*, J. M. Chaiken and R. C. Larson, October 1971.

P-4745, *Allocation of Emergency Units: Response Areas*, J. M. Chaiken, December 1971.

P-5249, *An Approach to Solving Municipal Emergency Service Deployment Problems*, W. E. Walker, June 1974.

P-5463, *Using Simulation to Develop and Validate Analytical Emergency Service Deployment Models*, E. J. Ignall, P. Kolesar, and W. E. Walker, August 1975.

HOUSING

In 1968, the Institute began a three-year study of New York City's rental housing to help the City operate its housing development program and manage its huge housing inventory. At that time, the Housing and Development Administration was hampered by inadequate data concerning the existing housing stock—its quality, quantity, and costs of operation, and its inhabitants' ability to pay rentals sufficient to cover the full costs of well-maintained housing. From an initial emphasis on helping HDA develop an efficient reporting and control system, and on estimating the costs of operating and maintaining housing, the Institute turned to the problem of rescuing existing housing from deterioration and abandonment.

The Institute's studies were instrumental in inducing the City to evaluate and redirect some of its housing management and development policies. The City's approach had previously been to promote the building of new rental units with public assistance, while maintaining a system of rent control that encouraged the decay and ultimate abandonment of much of the City's existing rental housing. The Institute's recommendations, based on its study of how City programs affected housing deterioration and loss, led to changes in New York City's basic rent control system. The study helped City officials set up a gradually phased program of increased rents for previously controlled units, where landlords would turn the increased revenues into rehabilitation and maintenance of their apartments.

In its evaluation of programs designed to slow the deterioration of housing, the Institute also considered such measures as government subsidies for the poor, tighter code enforcement to eliminate health and safety hazards, clinical treatment of problem buildings, and changes in building ownership. Its recommendations to provide rental assistance to residents unable to afford adequate housing were instrumental in prompting the Department of Housing and Urban Development to mount the large-scale experimental housing

allowance program, for which Rand is conducting the supply experiment discussed under the section on Rand's housing program.

R-610-NYC, *An Economic Analysis of New York City's Mitchell-Lama Housing Program*, J. S. DeSalvo, June 1971.

R-634-NYC, *Factors Affecting Maintenance and Operating Costs in Federal Public Housing Projects*, C. P. Rydell, December 1970.

R-648-NYC, *Housing Code Enforcement in New York City*, M. B. Teitz and S. Rosenthal, February 1971.

R-649-NYC, *Rental Housing in New York City: Vol. II, The Demand for Shelter*, I. S. Lowry, J. S. DeSalvo, and B. M. Woodfill, June 1971.

R-649-NYC (Abridged), *Rental Housing in New York City: Vol. II, The Demand for Shelter*, I. S. Lowry, J. S. DeSalvo, and B. M. Woodfill, June 1971.

R-786-NYC, *New York City's Mitchell-Lama Program: Middle-Income Housing?*, B. M. Woodfill, June 1971.

R-1055-NYC, *Factors Affecting Maintenance and Operating Costs in Private Housing*, K. M. Eisenstadt, August 1972.

RM-5673-NYC, *A Guide to Government Activities in New York City's Housing Markets*, D. J. Dreyfuss and J. Hendrickson, November 1968.

RM-6190-NYC, *Rental Housing in New York City: Vol. I, Confronting the Crisis*, I. S. Lowry (ed.), February 1970.

P-4002, *Research on New York City's Housing Problems*, I. S. Lowry, December 1968.

P-4129, *An Analysis of Alternative Measures of Tenant Benefits of Government Housing Programs with Illustrative Calculations from Public Housing*, E. O. Olsen and J. R. Prescott. November 1969.

P-4256, *Can Public Construction and Rehabilitation Increase the Quantity of Housing Service Consumed by Low-Income Families?*, E. O. Olsen, December 1969.

P-4257, *The Effects of a Simple Rent Control Scheme in a Competitive Housing Market*, E. O. Olsen, December 1969.

P-4258, *An Efficient Method of Improving the Housing of Low Income Families*, E. O. Olsen, December 1969.

P-4364-1, *A Methodology for Evaluating Housing Programs*, J. S. DeSalvo, September 1970.

P-4437, *Effects of the Property Tax on Operating and Investment Decisions of Rental Property Owners*, J. S. DeSalvo, August 1970.

P-4477, *The Landlord Reinvestment Model: A Computer Based Method of Evaluating the Financial Feasibility of Alternative Treatments for Problem Buildings*, C. P. Rydell, October 1970.

P-4570, *Reforming Rent Control in New York City: The Role of Research in Policy Making*, I. S. Lowry, November 1970.

P-4645, *Housing Assistance for Low-Income Urban Families: A Fresh Approach*, I. S Lowry, May 1971.

P-4683, *Reforming Rent Control in New York City: Analysis of Housing Expenditures and Market Rentals*, J. S. DeSalvo, July 1971.

P-4932, *An Examination of Four Housing Policies for New York City*, K. L. Rider, November 1972.

P-5050, *Pirate Settlements, Housing Construction by Incremental Development, and Low Income Housing Policies in Bogota, Columbia*, G. G. Vernez, May 1973.

P-5328, *A Housing Services Policy for Low-Income Urban Families in Underdeveloped Countries*, G. G. Vernez, December 1974.

P-5564, *Measuring the Supply Response to Housing Allowances*, C. P. Rydell, January 1976.

Economic Development

R-571-NYC, *Changing Patterns of Employment in the New York Metropolitan Area*, W. A. Johnson, December 1971.

R-1996-NYC, *Identification of Growth Industries for New York City*, G. G. Vernez, R. R. Mudge, R. J. Vaughan, November 1977.

HEALTH

Research in the health area was concerned with health manpower, emergency and outpatient care, hospital use and facilities, and such long-range issues as the potential impact of national health insurance and improved resource allocation methods. The Institute helped plan and operate six Community Mental Health Centers; studied the causes of, and suggested solutions to, the chronic shortage of professional nurses in the municipal hospital system; and offered alternatives to help the City's Health and Hospital Corporation meet its severe budget deficit.

In 1970, the Institute undertook an examination of the hospital needs of the City, intended to guide the Health Services Administration in locating new hospital facilities. The investigation actually uncovered an oversupply of facilities. The Institute's findings laid the foundation for further analysis by the Health Services Corporation and the Health and Hospital Corporation, eventually resulting in the elimination of more than 1200 beds. This economic gain to the City was made possible with no decrease in service.

Earlier research included the development of a screeing program for children in danger of lead poisoning—a program that enabled the City to uncover

1600 cases in time for effective treatment. The Institute also addressed a variety of issues of immediate concern, such as narcotics addiction, alcholism, family planning, day care programs, decentralized health planning, home care, and care for handicapped children.

R-789-NYC, *Cost/Output Analysis of Alternative Procedures for a Hospital Surveillance Program*, R. Goldstein, August 1971.

R-836-NYC, *The Supply of Professional Nurses and Their Recruitment and Retention by Hospitals*, K. A. Archibald, July 1971.

R-1096-NYC/OEO, *Population Health Survey 1968: Codebook and Marginals*, J. P. Acton, L. J. Clark, and R. J. Young, January 1973.

R-1151-OEO/NYC, *Demand for Health Care among the Urban Poor, with Special Emphasis on the Role of Time*, J. P. Acton, April 1973.

R-1161-NYC/OEO, *Population Health Surveys for 1964, 1965, and 1966: Codebook and Marginals*, J. P. Acton, L. J. Clark, and R. J. Young, January 1973.

R-1162-NYC/OEO, *Population Health Survey for 1969-70: Codebook and Marginals*, J. P. Acton, L. J. Clark, and R. J. Young, January 1973.

R-1189-OEO/NYC, *Demand for Health Care when Time Prices Vary More than Money Prices*, J. P. Acton, May 1973.

R-1469-NYC, *Methods for Assessing Inpatient Nurse Staffing Requirements*, J. M. Tien, April 1974.

RM-5774-NYC, *The New York City Health Budget in Program Terms*, C. Teng, February 1969.

RM-6339-NYC, *Planning Public Expenditures on Mental Health Service Delivery*, F. A. Sloan, February 1971.

P-4068-1, *Lifetime Earnings and Physicians' Choice of Specialty*, F. A. Sloan, December 1969.

P-4075, *The Demand for Medical Education—A Study of Medical School Applicant Behavior*, F. A. Sloan, April 1969.

P-4731, *Blood Bank Inventory Control*, J. B. Jennings, October 1971.

LAW ENFORCEMENT AND CRIMINAL JUSTICE

The Institute conducted a wide range of criminal justice studies examining the operations of the City's Police Department, court system, and correctional facilities. The major part of the work for the Police Department was aimed at improving the allocation of manpower. Over a period of several years, staff members collected and analyzed data on patrolmen's activity and police communication and dispatching systems. They developed and demonstrated com-

puterized simulation, queueing, and allocation models, permitting Department planners to perform detailed studies of deployment changes without initiating costly field experiments. The Institute's efforts to improve the police emergency response system at times of high demand were partially responsible for the City's decision to establish a "fourth platoon," a major reallocation of police manpower that more than doubled the number of men available at times of greatest need.

The Institute also designed a method of allocating patrolmen more efficiently to the various precints. This systems takes into account neighborhood population density, crime rate, number of street miles, and arrest rates in determining where additional men should be assigned and in predicting some of the probable effects of such assignments.

The Institute undertook its study of the City's court system to help the Court devise ways of speeding up operating procedures and reducing costs. Statistical techniques developed by the Institute now enable the Court to monitor and evaluate its performance and the progress of administrative reforms. For the Department of Corrections, the Institute provided assistance in applying new technologies in correctional facilities and in developing systems to examine the costs and benefits of alternative policies and operations.

Police

R-529-NYC, *An Analysis of the Apprehension Activities of the New York City Police Department*, P. W. Greenwood, September 1970.

R-621-NYC, *The Police Internal Administration of Justice in New York City*, B. Cohen, November 1980.

R-655-NYC, *Improving Public Safety in Urban Apartment Dwellings: Security Concepts and Experimental Design for New York City Housing Authority Buildings*, W. B. Fairley, M. I. Liechenstein, and A. F. Westin, June 1971.

R-673-NYC/HUD, *Measuring the Response Patterns of New York City Police Patrol Cars*, R. C. Larson, July 1971.

R-702-NYC, *Minority Recruiting in the New York City Police Department: Part I. The Attraction of Candidates; Part II. The Retention of Candidates*, I. C. Hunt, Jr., and B. Cohen, May 1971.

R-704-NYC, *Some Effects of an Increase in Police Manpower in the 20th Precinct of New York City*, S. J. Press, October 1971.

R-999-DOJ, *Police Background Characteristics and Performance*, B. Cohen and J. M. Chaiken, August 1972.

R-999-DOJ (Abridged), *Police Background Characteristics and Performance: Summary*, B. Cohen and J. M. Chaiken, May 1972.

R-1289-NYC, *Police Civil Service Selection Procedures in New York City: Comparison of Ethnic Groups*, J. M. Chaiken and B. Cohen, May 1973.

R-1424-NYC, *The Impact of Police Activity on Crime: Robberies on the New York City Subway System*, J. M. Chaiken, M. Lawless, and K. A. Stevenson, January 1974.

R-1566/6-HUD, *Implementing the Hypercube Queueing Model in the New Haven Department of Police Services: A Case Study in Technology Transfer*, K. Chelst, July 1975.

R-1625/1-HUD, *A Simulation Model of Police Patrol Operations: Executive Summary*, P. Kolesar and W. E. Walker, March 1975.

R-1625/2-HUD/NYC, *A Simulation Model of Police Patrol Operations: Program Description*, P. Kolesar and W. E. Walker, February 1975.

R-1695-NYC, *Algorithms for Alleviating Saturation of New Yorks City's Computerized SPRINT Police Dispatching System*, P. Kolesar, July 1975.

R-1803-NYC, *Guidelines for Scheduling Police Patrol Cars*, P. Kolesar, K. L. Rider, and T. B. Crabill, December 1976.

RM-5846-NYC, *Applying the Concepts of Program Budgeting to the New York City Police Department*, A. J. Tenzer, J. B. Benton, and C. Teng, June 1969.

P-4250, *Public Order Studies in New York City*, S. Wildhorn, November 1969.

P-4920, *Prior Arrest Record and Police Performace: Testimony before the City of New York Commission on Human Rights*, B. Cohen, May 1972.

P-4966, *New York City's Police: The Background and Performance of the Class of '57*, B. Cohen and J. M. Chaiken, February 1973.

P-5043, *Dismissal of Narcotics Arrest Cases in the New York City Criminal Court, 1970*, S. C. Cooper, July 1973.

P-5203, *The Impact of Police Activity on Subway Crime*, J. M. Chaiken, M. Lawless, and K. A. Stevenson, March 1974.

P-5260-1, *A Queueing-Linear Programming Approach to Scheduling Police Patrol Cars*, P. Kolesar, K. L. Rider, T. B. Crabill, and W. E. Walker, March 1975.

P-5464, *Validation of a Police Patrol Simulation Model*, T. B. Crabill, W. E. Walker, and P. Kolesar, June 1975.

Corrections

R-806-NYC, *Assessing Correctional Officer Manpower Requirements: A Methodology Based on the New York City Department of Correction*, M. I. Liechenstein, June 1971.

P-4621, *A Review of M. A. P. Willmer's Book, "Crime and Information Theory."* M. I. Liechenstein, April 1971.

P-4633, *Designing for Security*, M. I. Liechenstein, April 1971.

P-4656, *Reducing Crime in Apartment Dwellings: A Methodology for Comparing Security Alternatives*, M. I. Liechenstein, June 1971.

P-4842, *Employment Problems of the Ex-Offender: Testimony before the City of New York Commission on Human Rights*, M. I. Liechenstein, May 1972.

P-4959, *Professional Studies in Social Work with Emphasis on Social Deviation and Criminology: An Evaluation at the University of Puerto Rico*, B. Cohen, M. Riedel, P. D. Santana, and R. Munoz, February 1973.

Courts

R-638-NYC, *The Flow of Arrested Adult Defendants through the Manhattan Criminal Court in 1968 and 1969*, J. B. Jennings, January 1971.

R-1013-NYC, *Evaluation of the Manhattan Criminal Court's Master Calendar Project: Phase 1—February 1-June 30, 1971*, J. B. Jennings, January 1972.

R-1236-NYC, *Analysis of the Night and Weekend Arraignment Parts in the Bronx and Queens Criminal Courts*, J. B. Jennings, April 1973.

R-1285.NYC, *Final Evaluation of the Manhattan Criminal Court's Master Calendar Project*, J. B. Jennings, November 1973.

RM-6364-NYC, *The Flow of Defendants through the New York City Criminal Court in 1967*, J. B. Jennings, September 1970.

P-4581, *Potential Uses of the Computer in Criminal Courts*, P. W. Greenwood, February 1971.

P-4641, *Quantitative Models of Criminal Courts*, J. B. Jennings, May 1971.

P-4709, *The Design and Evaluation of Experimental Court Reforms*, J. B. Jennings, October 1971.

P-4732, *A Theory of Court Scheduling*, J. B. Jennings, October 1971.

P-5041, *Evaluating Administrative Court Reforms*, J. B. Jennings, June 1973.

WATER RESOURCES

The Domestic Research Division's research over the past few years on the mathematical modeling of water flow and indicators of water quality, now in progress for the Netherlands and the U.S. Department of the Interior, stemmed directly from earlier studies at the New York City–Rand Institute. In the late 1960s, the Institute began work on developing two-dimensional mathematical models of the flow of water and the transport of pollutants in Jamaica Bay. This project, begun with corporate funds and later supported by

New York's Environmental Protection Administration, arose in response to two developments. First, the City of New York had resolved to clean up Jamaica Bay, an ecologically important body of water whose recreational potential had scarcely been realized. At the same time, the U.S. Army Corps of Engineers was considering building a hurricane barrier to protect low-lying areas of the Bay.

City officials were uncertain about the effects of such a barrier. At the time, only a physical model of the harbor area could predict the impact of any intrusion on the Bay. Physical models, however, are limited to simulating the rise and fall of tides; they cannot take into account other important factors affecting water quality. The Institute therefore developed a two-dimensional mathematical model, incorporating such factors as the level and spread of pollutants, to demonstrate how water quality throughout the Bay would be affected by improvements in water treatment facilities or by artificial changes in the shape of the Bay. The model is now being refined and applied to other water bodies and waterways, with the aim of making the policy analysis of the treatment of coastal areas more effective.

R-708-NYC, *A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. II, Computation Procedures*, J. J. Leendertse and E. C. Gritton, July 1971.

R-709-NYC, *A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. III, Jamaica Bay Simulation*, J. J. Leendertse and E. C. Gritton, July 1971.

R-1009-NYC, *A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. IV, Jamaica Bay Tidal Flows*, J. J. Leendertse, July 1972.

R-1010-NYC, *A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. V, Jamaica Bay Rainstorms*, E. C. Gritton, July 1972.

R-1586-NYC, *A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. VI, Simulation, Observation, and State Estimation*, J. J. Leendertse and D. S. K. Liu, September 1974.

R-1612-NYC, *Comparison of Observed Estuarine Tide Data with Hydraulic Model Data by Use of Cross-Spectral Density Functions*, J. J. Leendertse and D. S. K. Liu, September 1974.

R-1622-NYC, *Stochastic Analysis and Control of Urban Estuarine Water-Quality Systems: Vol. 1—Estimation and Prediction*, D. S. K. Liu, December 1974.

R-1774-NYC, *A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. VII, A Hindcast*, J. J. Leendertse and D. S. K. Liu, July 1975.

R-1791-NYC, *A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. VIII, An Engineering Assessment*, J. J. Leendertse and D. S. K. Liu, December 1975.

RM-6230-RC, *A Water-Quality Simulation Model for Well-Mixed Estuaries and Coastal Seas: Vol. I, Principles of Computation*, J. J. Leendertse, February 1970.

P-4163, *Environmental Simulation Tool in a Marine Waste Disposal Study of Jamaica Bay*, J. J. Leendertse, March 1970.

P-4810, *The Behavior of the Water Quality Simulation Model*, J. J. Leendertse, April 1972.

WELFARE

During the ten years from 1963 to 1973, New York City's welfare caseload more than tripled. Although the City was financing and managing a system on a scale unmatched by any other local government, its officials found themselves without the information needed to address critical questions concerning New York City's welfare population and its alarming increase: Who were the welfare poor? Why were they on welfare? How effective were job referral and job training programs in reducing caseloads? Who were the eligible non-welfare poor and what kept them off the welfare rolls?

In 1972, Rand began a series of analytic studies to help the City's Human Resources Administration reach a firmer understanding of the characteristics and causes of welfare dependency. The studies were broadly aimed at identifying who was on the rolls and determining the economic, social, and demographic factors of caseload growth. During the course of the research, the project staff compiled the first detailed historical file of welfare users in the United States, a data base permitting the City's Department of Social Services to trace the dependency history of one million cases on welfare since 1967.

Related studies included an examination of welfare participation among the eligible poor, an evaluation of job training and employment programs, and an analysis of hospital use rates among Medicaid-paid welfare recipients. Computer models were developed to provide the Department of Social Services with monthly caseload predictions to use in calculating fiscal year budgets, and to enable the analysis of long-term caseload dynamics by helping to identify factors in caseload change, such as birth, employment, and allowance levels.

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R-791-NYC, *Protest by the Poor: The Welfare Rights Movement in New York City*, L. R. Jackson and W. A. Johnson, August 1973.

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R-1179-NYC, *Two Counts of Welfare in New York City: A Comparison of City and Census Data for 1969*, C. P. Rydell, December 1972.

R-1381-NYC, *The Welfare and Nonwelfare Poor in New York City*, D. M. deFerranti, S. Leeds, J. A. Grundfest, V. Leach, P. A. Parker, and L. L. Prusoff, June 1974.

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R-1991-NYC, *Model for Evaluation of Alternative Welfare Policies in New York City*, G. G. Vernez and G. Blais, December 1976.

R-1992-NYC, *Some Aspects of Ambulatory Care under Medicaid in New York City*, M. D. Menchik, November 1977.

R-1995-NYC, *Hospital Use under Medicaid in New York City*, M. D. Menchik, November 1977.

R-2002-HEW, *Multiple Welfare Benefits in New York City*, D. W. Lyon, P. A. Armstrong, J. R. Hosek, and J. J. McCall, August 1976.

R-2119-RC, *Welfare Policy Research for New York City: The Record of a Five-Year Project*, D. W. Lyon, December 1976.

P-5102, *The Residential Movements of Low-Income Families: The Case of Bogota, Columbia*, G. G. Vernez, October 1973.

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P-5566, *Welfare Policy Research for new York City: Findings on the Dynamics of Dependency*, D. W. Lyon, C. P. Rydell, and M. D. Menchik, December 1975.

APPENDIX

BOARD OF TRUSTEES
CORPORATE ORGANIZATION
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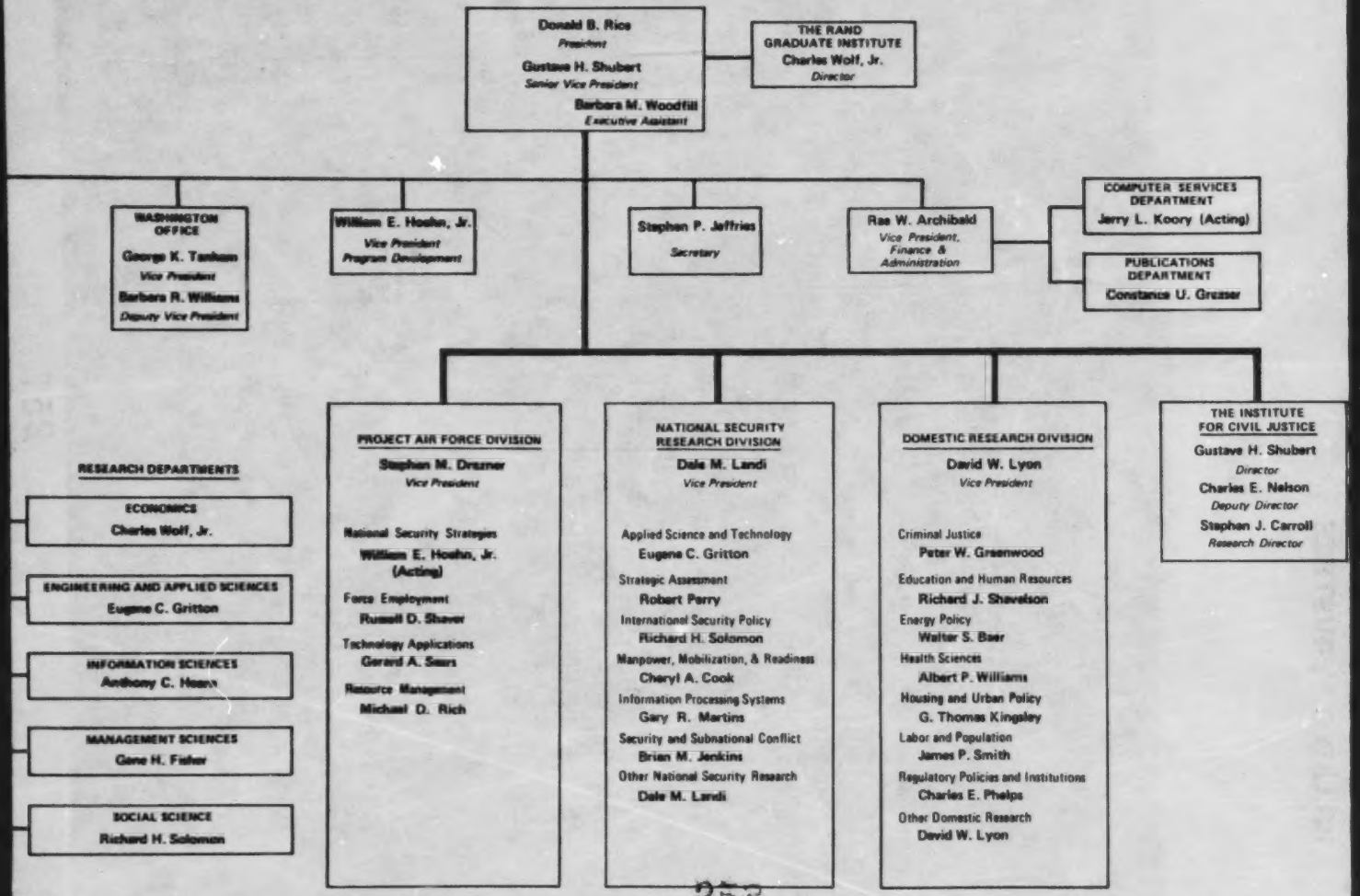

SUBSCRIPTION LIBRARIES

Over 330 libraries in the United States and 35 other countries maintain collections of unclassified Rand publications, as shown below. Provided on an annual subscription basis, these collections are available to library patrons on the same basis as other holdings and are subject to the same rules and regulations. Individual publications can usually be obtained by other libraries through the Interlibrary Loan Service, and subscription libraries are authorized to reproduce materials from the Rand collection for their patrons.

The date in parentheses after each university or public library listing is the initial subscription date, to indicate the depth of holdings.

SUBSCRIPTION LIBRARIES IN THE UNITED STATES

ALABAMA	
Auburn 36830	Auburn University, Ralph Brown Draughon Library (1965)
Jacksonville 36265	Jacksonville State University, Cole Library (1973)
University 35486	University of Alabama Library (1971)
ALASKA	
Fairbanks 99701	University of Alaska, Elmer E. Rasmuson Library (1968)
ARIZONA	
Tempe 85281	Arizona State University Library (1966)
Tucson 85721	University of Arizona Library (1965)
ARKANSAS	
Fayetteville 72701	University of Arkansas Library (1970)
CALIFORNIA	
Bakersfield 93309	California State College Library (1972)
Berkeley 94720	University of California, General Library (1953)
Chico 95926	Chico State University Library (1963)
Davis 95616	University of California Library (1969)
Dominguez Hills 90747	California State College Library (1972)
Fullerton 92634	California State University Library (1968)
Irvine 92664	University of California, General Library (1965)
Long Beach 90802	Long Beach Public Library (1972)
Los Angeles 90009	Aerospace Corporation
Los Angeles 90032	California State University, John F. Kennedy Memorial Library (1974)
Los Angeles 90024	University of California, University Research Library (1953)
Los Angeles 90007	University of Southern California Library (1965)
Monterey 93940	Naval Postgraduate School Library (1972)

Palo Alto 94303	Jerry Chen
Palo Alto 94303	Education and Science Society
Palo Alto 94303	Kentex International, Inc.
Palo Alto 94305	Kentex Research Library, Stanford University Branch (1979)
Palo Alto 94305	Stanford University, Office of Design and Construction (1979)
Palo Alto 94303	Suntek Associates
Pasadena 91109	California Institute of Technology, General Library (1953)
Pomona 91768	California State Polytechnic University Library (1968)
Redondo Beach 90278	TRW Systems Group, Technical Library (1974)
Riverside 92507	University of California Library (1967)
Rohnert Park 94928	California State College Library, Sonoma (1970)
Sacramento 95809	California State Library (1969)
Sacramento 95819	California State University Library (1972)
San Diego 92138	General Dynamics, Convair Division
San Diego 92182	San Diego State University, Malcolm A. Love Library (1973)
San Francisco 94105	Golden Gate University Library (1977)
San Luis Obispo 93407	California State Polytechnic University, Dexter Memorial Library (1970)
Santa Barbara 93106	University of California Library (1968)
Santa Clara 95050	Mildred L. Tseng
Santa Clara 95053	University of Santa Clara, Orradre Library (1971)
Santa Cruz 95060	University of California Library (1969)
Stanford 94305	Stanford University, Engineering Library (1953)

COLORADO

Boulder 80302	University of Colorado Libraries (1977)
Colorado Springs 80840	U.S. Air Force Academy, Library (DFSLB) (1968)
Denver 80203	Denver Public Library (1953)
Denver 80218	Johns-Manville Corporation
Denver 80210	University of Denver Libraries (1973)
Englewood 80111	Science Applications, Inc., FSRC Library
Fort Collins 80521	Colorado State University Libraries (1973)
Greeley 80631	University of Northern Colorado Library (1973)

CONNECTICUT

East Hartford 06108	Pratt Whitney Aircraft Group, Technology and Planning Communications Center (1979)
Fairfield 06431	General Electric Company, Data Center
Hartford 06115	Connecticut State Library (1980)
Middletown 06457	Wesleyan University, Olin Library (1970)
New Haven 06520	Yale University Library (1953)
Storrs 06268	University of Connecticut, Wilbur Cross Library (1963)

DELAWARE

Newark 19711	University of Delaware Library (1972)

FLORIDA

Coral Gables 33124	University of Miami, Otto G. Richter Library (1967)
Gainesville 32603	University of Florida, Engineering and Physics Library (1953)
Miami 33144	Florida International University Library (1972)
Orlando 32816	University of Central Florida Library (1970)
Tallahassee 32306	Florida State University Library (1972)
Tampa 33620	University of South Florida Library (1970)

GEORGIA

Athens 30601	University of Georgia Libraries (1967)
Atlanta 30313	Atlanta University, Trevor Arnett Library (1979)
Atlanta 30332	Georgia Institute of Technology, Price Gilbert Library (1953)
Atlanta 30303	Georgia State University Library (1972)
Statesboro 30458	Georgia Southern College Library (1974)

HAWAII	
Honolulu 96822	University of Hawaii Library (1953)
IDAHO	
Boise 83707	Boise State College (1971)
ILLINOIS	
Carbondale 62901	Southern Illinois University, Morris Library (1975)
Charleston 61920	Eastern Illinois University, Booth Library (1963)
Chicago 60659	Warren Ball—IMC, OCS America, Inc.
Chicago 60611	Chicago Public Library (1973)
Chicago 60637	University of Chicago Library (1953)
Chicago 60680	University of Illinois at Chicago Circle, Library (1974)
DeKalb 60115	Northern Illinois University, Founders Memorial Library (1964)
Edwardsville 62025	Southern Illinois University, Lovejoy Library (1972)
Evanston 60201	Northwestern University Library (1969)
Macomb 61455	Western Illinois University Library (1974)
Normal 61761	Illinois State University Library (1970)
Springfield 62756	Illinois State Library (1972)
Springfield 62708	Sangamon State University Library (1966)
Urbana 61801	University of Illinois Library (1953)
INDIANA	
Bloomington 47401	Indiana University Library (1966)
Indianapolis 46204	Indiana State Library (1978)
Indianapolis 46202	Indiana University-Purdue University, Downtown Campus Library (1971)
Lafayette 47907	Purdue University Library (1953)
Muncie 47306	Ball State University Library (1976)
Notre Dame 46556	University of Notre Dame, Memorial Library (1970)
IOWA	
Ames 50010	Iowa State University Library (1953)
Iowa City 52242	University of Iowa Libraries (1953)
KANSAS	
Emporia 66801	Emporia State University, William Allen White Library (1975)
Hays 67601	Fort Hays Kansas State College, Forsyth Library (1971)
Lawrence 66044	University of Kansas Libraries (1970)
Manhattan 66504	Kansas State University, Farrell Library (1965)
Wichita 67208	Wichita State University Library (1970)
KENTUCKY	
Bowling Green 42101	Western Kentucky University, Helm-Cravens Library (1973)
Highland Heights 41076	Northern Kentucky State College Library (1973)
Lexington 40506	University of Kentucky Library (1953)
LOUISIANA	
Baton Rouge 70813	Southern University Library (1972)
Lafayette 70504	University of Southwestern Louisiana Libraries (1974)
New Orleans 70118	Tulane University, Science Library (1965)
MAINE	
Waterville 04901	Colby College, Miller Library (1979)

MARYLAND	
Baltimore 21218	Johns Hopkins University, Milton S. Eisenhower Library (1953)
Baltimore 21204	Towson State College, Albert S. Cook Library (1972)
Baltimore 21201	University of Baltimore Library (1975)
College Park 20742	University of Maryland, Engineering Library (1966)
MASSACHUSETTS	
Amherst 01002	University of Massachusetts Library (1967)
Boston 02117	Boston Public Library (1963)
Boston 02115	Northeastern University Library (1975)
Cambridge 02138	Harvard University, Godfrey Lowell Cabot Science Library (1953)
Cambridge 02339	Massachusetts Institute of Technology Libraries (1953)
Chestnut Hill 02167	Boston College, Bapst Library (1965)
Springfield 01119	Western New England College, Churchill Library (1980)
MICHIGAN	
Ann Arbor 48109	University of Michigan, Engineering-Transportation Library (1953)
Detroit 48202	Detroit Public Library (1966)
East Lansing 48824	Michigan State University Library (1965)
Kalamazoo 49001	Western Michigan University, Dwight B. Waldo Library (1965)
Lansing 48909	Michigan Department of Education (1974)
Mt. Pleasant 48859	Central Michigan University Library (1974)
Warren 48090	General Motors Corporation
Ypsilanti 48197	Eastern Michigan University Library (1971)
MINNESOTA	
Minneapolis 55401	Minneapolis Public Library (1971)
Minneapolis 55455	University of Minnesota Libraries (1953)
MISSISSIPPI	
University 38677	University of Mississippi Library (1972)
MISSOURI	
Columbia 65201	University of Missouri Library (1965)
Kirksville 63501	Northeast Missouri State University, Pickler Library (1970)
Maryville 64468	Northwest Missouri State University, Wells Library (1976)
St. Louis 63121	University of Missouri at St. Louis, Thomas Jefferson Library (1964)
St. Louis 63130	Washington University Libraries (1953)
St. Louis 63105	R. S. Weinberg and Associates
NEBRASKA	
Lincoln 68588	University of Nebraska Libraries (1953)
Omaha 68182	University of Nebraska at Omaha, University Library (1979)
NEVADA	
Carson City 89701	Nevada State Library (1974)
Las Vegas 89109	University of Nevada Library (1966)
Reno 89507	University of Nevada Library (1967)
NEW HAMPSHIRE	
Durham 03824	University of New Hampshire Library (1971)
Hanover 03755	Dartmouth College, Baker Library (1968)

NEW JERSEY	
New Brunswick 08903	Rutgers University, Alexander Library (1978)
Newark 07101	Newark Public Library (1972)
Princeton 08540	Princeton University Library (1953)
Trenton 08625	Trenton State College, Roscoe L. West Library (1969)
NEW MEXICO	
Albuquerque 87131	University of New Mexico, General Library (1968)
NEW YORK	
Albany 12224	New York State Library (1968)
Albany 12203	State University of New York at Albany, Library (1970)
Bethpage 11714	Grumman Aerospace Corporation
Binghamton 13901	State University of New York at Binghamton, Library (1971)
Brooklyn 11225	Brooklyn Public Library (1970)
Buffalo 14203	Buffalo & Erie County Public Library (1963)
Canton 13617	St. Lawrence University Library (1969)
New Rochelle 10801	Iona College, Ryan Library (1973)
New York 10027	Columbia University, Lehman Library (1953)
New York 10017	The Libyan Mission to the United Nations (1979)
New York 10018	New York Public Library (1953)
New York 10021	The Rockefeller University Library (1979)
New York 10022	Sumitomo Corporation of America, Inc.
Niagara University 14109	Niagara University Library (1970)
Rochester 14627	University of Rochester Library (1969)
Stony Brook 11794	State University of New York at Stony Brook, Library (1965)
Syracuse 13210	Syracuse University Library (1965)
Utica 13502	State University of New York at Utica, Upper Division College Library (1970)
NORTH CAROLINA	
Boiling Springs 28017	Gardner-Webb College Library (1980)
Chapel Hill 27514	University of North Carolina, Wilson Library (1971)
Davidson 28036	Davidson College Library (1972)
Durham 27706	Duke University Library (1953)
Greensboro 27412	University of North Carolina at Greensboro, Library (1972)
Raleigh 27607	North Carolina State University, D. H. Hill Library (1973)
OHIO	
Cincinnati 45202	Public Library of Cincinnati (1969)
Cincinnati 45221	University of Cincinnati, Main Campus Library (1969)
Cleveland 44106	Case Western Reserve University, Sears Library (1965)
Cleveland 44114	Cleveland Public Library (1953)
Cleveland 44115	Cleveland State University Library (1977)
Columbus 43210	Ohio State University Libraries (1953)
Dayton 45433	Air Force Institute of Technology Library (1967)
Kent 44242	Kent State University Library (1963)
Oxford 45056	Miami University Libraries (1971)
Toledo 43606	University of Toledo Library (1970)
OKLAHOMA	
Norman 73069	University of Oklahoma Library (1953)
Tahlequah 74464	Northeastern Oklahoma State University Library (1972)
Tulsa 74104	University of Tulsa, McFarlin Library (1973)
OREGON	
Ashland 97520	Southern Oregon College Library (1969)
Portland 97207	Portland State University Library (1970)
Salem 97310	Oregon State Library (1970)

PENNSYLVANIA	
Philadelphia 19104	Drexel University Library (1971)
Philadelphia 19122	Temple University Library (1970)
Pittsburgh 15213	Carnegie Library of Pittsburgh (1953)
Pittsburgh 15260	University of Pittsburgh, Hillman Library (1968)
Swarthmore 19081	Swarthmore College Library (1976)
University Park 16802	Pennsylvania State University, Pattee Library (1965)
RHODE ISLAND	
Providence 02912	Brown University Library (1953)
SOUTH CAROLINA	
Clemson 29631	Clemson University Library (1973)
Columbia 29208	University of South Carolina, Thomas Cooper Library (1969)
TENNESSEE	
Chattanooga 37401	University of Tennessee Library (1974)
Johnson City 37601	East Tennessee State University Library (1974)
Knoxville 37916	University of Tennessee Library (1972)
Memphis 38111	Memphis State University, John Brister Library (1964)
Nashville 37203	Vanderbilt University Library (1953)
TEXAS	
Austin 78712	University of Texas Library (1953)
College Station 77843	Texas A&M University Library (1965)
Dallas 75201	Dallas Public Library (1980)
Fort Worth 76129	Texas Christian University, Mary Couts Burnett Library (1978)
Houston 77001	Rice University Library (1958)
Houston 77004	University of Houston Libraries (1969)
Lubbock 79409	Texas Tech University Library (1969)
San Antonio 78284	Trinity University Library (1974)
San Antonio 78285	University of Texas at San Antonio Library (1971)
UTAH	
Provo 84601	Brigham Young University Library (1965)
Salt Lake City 84112	University of Utah, Marriott Library (1953-71, 1973)
VERMONT	
Burlington 05401	University of Vermont Library (1978)
VIRGINIA	
Blacksburg 24061	Virginia Polytechnic Institute and State University Library (1965)
Charlottesville 22901	University of Virginia, Alderman Library (1953)
Fairfax 22030	George Mason University Library (1979)
Lexington 24450	Virginia Military Institute, Preston Library (1968)
Richmond 23173	University of Richmond, Boatwright Memorial Library (1974)
Richmond 23284	Virginia Commonwealth University, James Branch Cabell Library (1975)
WASHINGTON	
Bellingham 98225	Western Washington State College, Wilson Library (1971)
Olympia 98501	Washington State Library (1970)
Pullman 99164	Washington State University Library (1967)
Seattle 98124	The Boeing Company, Renton Technical Library
Seattle 98195	University of Washington Libraries (1953)

WEST VIRGINIA	
Charleston 25305	West Virginia Library Commission (1973)
Glenville 26351	Glenville State College, Robert F. Kidd Library (1971)
Montgomery 25136	West Virginia Institute of Technology Library (1974)
WISCONSIN	
Eau Claire 54701	University of Wisconsin-Eau Claire, William D. McIntyre Library (1972)
Green Bay 54302	University of Wisconsin Library (1967)
Madison 53706	University of Wisconsin, Memorial Library (1953)
Milwaukee 53233	Marquette University, Memorial Library (1972)
Milwaukee 53233	Milwaukee Public Library (1971)
Milwaukee 53201	University of Wisconsin-Milwaukee, Library (1972)
Superior 54880	University of Wisconsin, Hill Library (1971)
WYOMING	
Laramie 82071	University of Wyoming Library (1971)

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DISTRICT OF COLUMBIA	
Washington 20310	Army Library, Department of the Army (1970)
Washington 20006	George Washington University Library (1970)
Washington 20540	Library of Congress (1953)

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PUERTO RICO	
Rio Piedras 00931	Universidad de Puerto Rico, Biblioteca General (1966)

SUBSCRIPTION LIBRARIES IN OTHER COUNTRIES

AUSTRALIA	
Adelaide, S.A.	State Library of South Australia (1971)
Brisbane, Queensland	State Library of Queensland (1973)
Bundoora, Victoria	La Trobe University Library (1971)
Canberra, A.C.T.	Australian National University, Institute of Advanced Studies Library (1968)
Canberra, A.C.T.	Department of Defence, Defence Central Library (1978)
Canberra, A.C.T.	National Library of Australia (1969)
Clayton, Victoria	Monash University Library (1972)
Duntroon, A.C.T.	Royal Military College, Bridges Memorial Library (1968)
Nedlands, W.A.	University of Western Australia Library (1973)
Sydney, N.S.W.	University of Sydney, Fisher Library (1958)
AUSTRIA	
Laxenburg	International Institute for Applied Systems Analysis (IIASA) Library (1972)

BELGIUM	
Namur	Bibliotheque Universitaire Moretus Plantin (1973)
Sint-Niklaas	Biblioteek Voor Hedendaagse Dokumentatie (1975)
BRAZIL	
Brasilia	Camara dos Deputados (1971)
Brasilia	Servico Federal de Processamento de Dados (SERPRO), Biblioteca (1971)
Sao Paulo	Cidade Universitaria, Instituto de Pesquisas Tecnologicas (1973)
CANADA	
Burnaby, B.C.	British Columbia Institute of Technology Library (1973)
Burnaby, B.C.	Simon Fraser University Library (1970)
Calgary, Alberta	University of Calgary Library (1973)
Downsview, Ontario	York University Libraries (1971)
Fredericton, N.B.	University of New Brunswick, Harriet Irving Library (1969)
Guelph, Ontario	University of Guelph Library (1968)
Halifax, N.S.	Dalhousie University Library (1968)
Hamilton, Ontario	McMaster University, Mills Memorial Library (1968)
London, Ontario	University of Western Ontario Library (1977)
Montreal, Quebec	McGill University Library (1968)
Montreal, Quebec	Concordia University Libraries (1969)
Ottawa, Ontario	Carleton University Library (1968)
Ottawa, Ontario	National Defence Headquarters, Scientific Information Services (1965)
Ottawa, Ontario	National Research Council Library (1958)
Quebec, Quebec	Les Presses de l'Universite Laval (1970)
Toronto, Ontario	University of Toronto Library (1968)
Vancouver, B.C.	University of British Columbia Library (1970)
Waterloo, Ontario	Wilfrid Laurier University Library (1972)
Windsor, Ontario	University of Windsor Library (1970)
Winnipeg, Manitoba	University of Manitoba, Elizabeth Dafoe Library (1973)
CANAL ZONE	
Balboa	Panama Canal College Library (1971)
CHILE	
Santiago	Biblioteca del Congreso Nacional (1977)
CHINA	
Taipei, Taiwan	Tamkang College of Arts and Sciences, Chueh Sheng Memorial Library (1970)
DENMARK	
Aarhus C	Statsbiblioteket, Universitetsparken
Fjerritslev	Per Gundersens Hus, Library (1972)
ENGLAND	
Bailrigg, Lancaster	University of Lancaster Library (1967)
Boston Spa, Yorkshire	British Library, Lending Division (1958)
Keele, Staffordshire	University of Keele Library (1972)
London, SW1A 2EU	Ministry of Defense, Whitehall Library (1967)
Oxford	Institute of Economics and Statistics (1971)
FRANCE	
Paris 16	Association Francaise pour la Cybernetique Economique et Technique, Library (1958)

Paris 16	Organisation for Economic Co-operation and Development, Library (1968)
GERMANY (WEST)	
Berlin	Preussischer Kulturbesitz, Staatsbibliothek (1974)
Berlin-Charlottenburg	Universitatsbibliothek der Technischen Universitat Berlin (1969)
Bonn	Deutscher Bundestag Bibliothek (1973)
Ebenhausen-Isartel	Stiftung Wissenschaft und Politik, Library (1966)
Frankfurt a.M.	Stadt- und Universitats Bibliothek (1958)
Gottingen	Niedersachsische Staats- und Universitatsbibliothek Gottingen (1970)
Hamburg	Staats- und Universitatsbibliothek (1971)
Hannover, Welfengarten	Bibliothek der Technischen Hoschschule und Technische Informationsbibliothek (1968)
Kiel	Bibliothek des Instituts fur Weltwirtschaft und der Universitat Kiel (1973)
Koln	Universitats- und Stadtbibliothek Koln (1970)
Konstanz	Universitat Konstanz Bibliothek (1971)
Munich	Industrieanlagen-Betriebsgesellschaft (1966)
Saarbrucken	Universitatsbibliothek der Universitat des Saarlands (1969)
GREECE	
Athens	Hellenic Air Force Command, Branch C, Research Directorate (1973)
HONG KONG	
Hong Kong	Far East Book Company
INDIA	
Bombay	National Institute of Bank Management, Library (1970)
Delhi	Defence Scientific Information and Documentation Centre, Defence Science Library (1967)
New Delhi-1	Indian Council of Social Science Research (1966)
INDONESIA	
Djakarta	Centre for Strategic and International Studies (1972)
ISRAEL	
Haifa	Israel Institute of Technology, Department of Industrial and Management Engineering (1965)
Haifa (Mt. Carmel)	University of Haifa Library (1974)
Tel-Aviv	Tel-Aviv University, Leon Recanati Graduate School of Business Administration, Library (1965)
ITALY	
Padova	Biblioteca Universitaria (1968)
S. Domenico di Fiesole	European University Institute Library (1978)
JAPAN	
Kamakura, Kanagawa	Nomura Research Institute (1967)
Niihari-gun Ibaragi	Tsukuba University Library (1978)
Tokyo	National Diet Library (1958)
Tokyo	Seisaku Kagaku Kenkyusho
Tokyo	Mitsubishi Sogo Kenkyujo, Library
Toyota-shi Aichi-ken	Gijutsu Shiryo Shitsu

JORDAN	
Amman	I. P. S. (1977)
Amman	Royal Society for Scientific Research (1966)
KOREA	
Seoul	Agency for Defense Development, Technical Library (1980)
KUWAIT	
Kuwait	Kuwait University Library (1975)
MALAYSIA	
Bangi, Selangor	Universiti Kebangsaan Malaysia, Library (1971)
Kuala Lumpur	National Library of Malaysia (1978)
Kuala Lumpur	University of Malaya Library (1974)
MEXICO	
Puebla, Puebla	Universidad de las Americas, Learning Resources Center Library (1972)
THE NETHERLANDS	
Delft	Technological University Library (1972)
NEW ZEALAND	
Wellington	General Assembly Library (1971)
NIGERIA	
Ibadan	Ibadan University Library (1972)
Ile - Ife	University of Ife Library (1980)
NORWAY	
Trondheim	University of Trondheim, Norwegian Institute of Technology (1971)
SCOTLAND	
Aberdeen	Aberdeen University Library (1973)
SINGAPORE	
Singapore 10	Ministry of Defence (1971)
SOUTH AFRICA	
Pretoria, Transvaal	Universiteit van Pretoria, Merensky-Biblioteek (1971)
SPAIN	
Madrid-4	Instituto de Cuestiones Internacionales (1980)
Madrid-34	Universidad Autonoma, Catedra Teoria Economica (1970)
SWEDEN	
Nykoping 1	Aktiebolaget Atomenergi Library (1958)
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Zurich	ETH - Bibliothek (1969)
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Rawalpindi	Defence Science Organization (1980)

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